facts of there being three separate instruments and requiring the simultaneous and rapid manipulations of two observers (and their subsequent efforts in setting off the angles on the protractor) have long been felt to be defects. And the hydrographic world has studied, but unsuccessfully, to devise an instrument that would do the work of these three. But this problem finds a solution in my *protracting sextant*, which enables one observer to accomplish in hydrography the desideratum of measuring at the same instant two angles, and plotting them with the same instrument.

We have represented here in the annexed figure, "The Protracting Sextant," consisting of a circle *D*, graduated to degrees and minutes from the zero point around by the right and left each way to one hundred and eighty degrees, and three radiating protractor arms, *f*, *g* and *h*. The arm *g*, is fixed with its true edge at the zero point of graduation, and the other two, *f* and *h*, are capable of being revolved around the hollow cylindrical axis of the circle. Between this fixed, and each of these movable protractor arms, we have an index arm—and each of these indices, *m* and *n*, also find in the center of the circle a common center of motion, and carries an index-mirror mounted perpendicular to its plane of motion but slightly eccentrically so that the hollow axis of the instrument can be readily gotten at. Along these index arms *m* and *n*, are cut rectangular slots (whose longitudinal axes are radii of the circle), in which slide the projecting ends of the pivots which rivet the equal rectangular bars, *o*, *s*, and *u*, *w*, together. And these indices and protractor arms are so connected by means of jointed parallelograms that the right hand index-arm always bisects the angle included between the fixed and right hand protractor arms, and the left hand index always bisects the angle contained by the fixed and left protractor arms.

Now by a well-known optical principle we know that the angular distance moved over by a mirror while measuring an angle is only one-half of the actual angle measured, and since each of the movable protractor arms of this instrument is by means of this jointed parallelogramic gearing, driven along its arc simultaneously with, and *twice as fast* as its corresponding index-arm (and mirror), we hence see that the angles included between the fixed and movable protractor arms are the actual angles which the indices (and their mirrors) have measured.

The index mirrors, *y* and *z*, may be mounted to move either in the same or in parallel planes, as shown in the forms of the writer's two-angle sextants described in the proceedings of the Academy, February 16th, 1874. A horizon glass, *x*, half-silvered to admit of direct and reflected vision is attached to the frame of the instrument nearly opposite the index mirrors, with its plane perpendicular to the plane of the instrument. The arms, *f* and *h*, are clamped and adjusted with the ordinary clamp and tangent screws, *l* and *k*.

The requisite adjustments of the "Protracting Sextant" are the same as those of the ordinary sextant. When observing with the new Protracting Sextant, the hydrographer holds it lightly in his right hand and moves it until its face is in the plane passing through his eye, *i*, and the three objects, *A*, *B*, *C*, whose angular distances are required, and then sets and clamps his index arm so that the reflected and direct images of the objects (say left hand and middle) of one of the angles which he is to measure, are not coincident

yet approaching on account of the progress of the boat; then with the second index glass he makes the direct and reflected images of the middle and right hand objects coincident, and keeps them coincident with tangent screw until the first two objects become coincident, then clamps, and he has the two angles observed at the same instant—and also has them set off on the proper limbs of the instrument simultaneously with, and by the same effort that measured the angles. And hence after measuring two connected angles with this instrument, we have only to lay it down on the "Field Sheet" (which should always be spread on a board before the observer in the boat), and shift it until the fiducial edges of the three protractor arms traverse the three points (representing the signals observed upon), and the center of the instrument will then occupy the relative place of the observer; now dot the center, and the position is plotted, without any of those tedious transfers of angles from the limbs of sextants to the limbs of the protractor, which are unavoidably incident to the execution of practical hydrography with the forms of sextants and protractors now in general use.

However, with the hydrographer, it is necessary to read the angles off of the instrument and record them for future reference and closer plotting on the "Office Sheet."

The angles observed with the Protracting Sextant, or any other reflecting instrument, are measured in the plane of the objects. If this plane be inclined to the horizon and a result rigorously accurate be sought, the angles of elevation of each station above the horizon should at the same time be observed to afford data for reducing the hypotheneusal to the horizontal angle. But this reduction may be neglected in all cases where the difference of elevation of the objects does not exceed two or three degrees, and when the observed angle is larger than (the minimum angles allowed in determining a boat's position by observations from the boat), twenty or twenty-five degrees—for the reduction to the horizon would, in such cases, deal with quantities more minute than the amount of error to which the measures of all angles observed at an unstable station are liable. When the difference of the objects is considerable, an ideal vertical line may be drawn from the highest object downward to an elevation corresponding to that of the lower object, and the angle measured between this vertical line and the lower object—this with some experience and correctness of eye, will give results sufficiently near the truth, *i.e.*, within the limit of the errors of plotting. Objects very close should not be observed on account of the parallax of the instrument.

The Protracting Sextant should have supplementary attachments (such as were described by the writer before the Academy, February 16th, 1874), so that angles between one hundred and forty and one hundred and eighty degrees may be measured with equal facility with those of smaller magnitude. But these larger angles cannot be plotted in the usual way, for they are too great to be set off at the same time on the limbs of the instrument because of the jamming of the movable protractor arms; now, under this contingency, if we have no tracing paper, and don't wish to sweep the circles of position, then we may use the following easy and accurate method of plotting by supplementary angles, viz.: Suppose A, B and C, the left, middle and right hand objects on which are measured two angles, too large to be set off on the

hydrography no less necessary than this skill and dexterity, is rapidity of execution in determining positions; and, to this end, with two observers, the requisite promptness and oneness of action are found deplorably deficient, and that, too, at moments the most critical. A sunken rock or reef is to be determined, and on it a sounding gotten. The rock is found, the "cast" is taken—the word "stand by for an angle" is given—and at length comes the response, r-e-a-d-y; by which time perhaps a tangent screw is jammed (hard up) or the boat has drifted from over the rock, and thus the reward, for hours, or it may be for days, of persistent and arduous exertions is lost. And such mishaps must ever continue to recur where two observers are called upon to act quickly and simultaneously under exciting circumstances.

But if in the boat there is *only one observer*, with a Protracting Sextant, then we may confidently expect that promptness and oneness of action, in observing, under every contingency, which are so essential to the rapid and successful execution of a hydrographic survey.

Although we do not presume to say that the the ry of this instrument is so obvious, or its manipulations so simple, that "the simpleton, though he run may understand," or that the smatterer and blind routiner (who could not look a quadrilateral in the face without blushing) may manipulate it with ease and accuracy, yet we do not assert without the fear of a contradiction, that to the eye of the ingenious geometer, its theory is most clear, and that in the hands of the hydrographer, who is a master of his profession, this Protracting Sextant will be found the ready and efficient means of determining and plotting (unassisted and alone) his position, with a facility, ease and accuracy not now attained with two ordinary sextants and one protractor in the hands of two observers and one plotter.

The Secretary read the following from Professor George Davidson:

Transit of Venus.

BY GEORGE DAVIDSON.

To the California Academy of Sciences, San Francisco, Cal.:—The instructions of the Commission permit me to give general results of our work, and I condense as much as possible for presentation to the Academy, our labors of preparation and final results.

We have determined the difference of longitude by cable, between Nagasaki and Vladivostok, whence it will be carried westward to St. Petersburg by telegraph, and in connecting the Venus Station with the Telegraph Observatory we have determined the latitude and longitude of the French Venus Station and two other points on the bay.

We have determined the latitude of our station by the Talcatt method; observing upon twenty pairs of stars for five nights.

We have observed fourteen occultations of stars by the moon for longitude differences with Peking and other stations. This was work which we had to

The following papers by Dr. J. G. Cooper were submitted:

The Origin of Californian Land-Shells.

BY J. G. COOPER, M. D.

In previous articles I have given some observations on the Distribution and Variations of the Californian Banded Land-shells, which naturally lead to the consideration of their probable origin or past history.

In the "Bulletin of the Museum of Comparative Zoölogy," (Cambridge, Mass., June, 1873, p. 202), Mr. W. G. Binney writes, "the west alone is left to us from whence to trace the Pulmonate Fauna of the Pacific region, and there the secret of its origin lies buried under the Pacific Ocean."

Mr. Binney probably alluded to the supposed existence of a continent in the South Pacific, embracing the mountain summits now forming the archipelago of Oceania, which became submerged, as Prof. Dana suggests, during the later tertiary period, while most of California was emerging from the ocean.

But even if this were proved to have happened, the great distance of the nearest islands (the Hawaiian) from us, and the great depth of the ocean between, as well as north of them, besides the total dissimilarity of their living land-shells from ours, forbids any supposition of a former land connection by which such animals could travel directly from one country to the other. A glance at a globe shows that the islands, besides being tropical and wholly south of lat. 23°, are as far from us as the Aleutian Islands, the Arctic Ocean, or Florida, and I propose to show that whatever migration to California has occurred, came from the direction of the regions named last.

No confirmation is given to a derivation from the west, by the more probable former existence of an "Atlantis" connecting the two continents across the Atlantic, the few island remnants of which really contain several species of land-shells common to one or both sides.

The great similarity of our banded groups to those of Europe has always been an argument for supposing them to have had a common origin. The same similarity is found in many others of our animals as well as plants, and is plainly connected with the well-known similarity of climates in the two countries. But as the known laws of nature do not permit us to consider climate as the cause of specific resemblances, we must look for some other way of accounting for them in this case.

The fact that very similar species exist in Japan and the Amoor Valley, Siberia, contradicts, indeed, the theory of climatic causes, since we know that the climate of those regions is very similar to that of our Atlantic States, where no similar species exist. At the same time, their existence there suggests the probable central point from which all originated.

Going back in geological history to the supposed beginning of all living species, few, if any, of the terrestrial, can be traced farther back than the

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PROCEEDINGS

OF THE

CALIFORNIA ACADEMY

OF

SCIENCES.

VOLUME VI.- ~~VII~~

1875.

SAN FRANCISCO.

1876.

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY

OF

SCIENCES.

ANNUAL MEETING, JANUARY 4TH, 1875.

Vice-President Hewston in the chair.

Fifty members present.

In the absence of the President, the Vice-President read the annual address.

The Corresponding Secretary read his annual report, stating that the correspondence is becoming more extensive and important with the growth of the Academy.

The Recording Secretary submitted a brief report, giving the average attendance at meetings as 31 members, and the total resident membership as 301, and the life membership 78.

The Treasurer's annual report places the balance on hand at $2,958.43.

The Librarian's report gives the number of books in the library at 5,000 volumes, 2,500 of which are bound.

Dr. A. B. Stout, from the committee appointed to gather information sought by the French Acclimatization Society, reported that certain of the questions had been answered by different individuals. The report was accepted, and Dr. Stout was

requested to forward the material to Consul Breuil, for transmission to the Acclimatizing Society of France.

The reports of the Judges and Inspectors of election were received, signed by J. H. Smythe and Henry Chapman, Judges, and John Currey and J. D. Pierson, Inspectors. They reported the result of the annual election, as follows:

PRESIDENT.

GEORGE DAVIDSON.

FIRST VICE-PRESIDENT.
HENRY EDWARDS.

SECOND VICE-PRESIDENT.
HENRY GIBBONS, SR.

CORRESPONDING SECRETARY.
HENRY G. HANKS.

RECORDING SECRETARY.
CHAS. G. YALE.

TREASURER.
ELISHA BROOKS.

LIBRARIAN.
WM. J. FISHER.

DIRECTOR OF MUSEUM.

ALBERT KELLOGG.

TRUSTEES.

DAVID D. COLTON,
JOHN HEWSTON, JR.,
ROBT. E. C. STEARNS,
GEO. E. GRAY,
RALPH C. HARRISON,
THOS. P. MADDEN,
WM. ASHBURNER.

REGULAR MEETING, JANUARY 18TH, 1875.

Second Vice-President Henry Gibbons, Sr., in the chair.

Seventeen members present.

Donations to the Museum: The Alaska Commercial Company donated two Aleutian mummies, a complete description of which appeared in the *S. F. Chronicle*, of January 8th, 1874; Jesse

Walton donated specimen of *Liparis pulchellus* (?) or *mucosus*, Ayres; Mr. B. L. Savory, of Tuolumne County, presented, through Mr. Brooks, two specimens of pound pear, one picked from the tree October 1st, 1873, and the other fresh.

The Vice-President stated that General Cobb had signified his intention of depositing in the Museum of the Academy, the articles found in the shell mound at Saucelito.

Dr. Kellogg exhibited plants, and read a paper on California and Colorado Loco Poisons.

California and Colorado "Loco" Poisons.

BY DR. A. KELLOGG.

Dr. Kellogg stated that very many thousands of horses, cattle and sheep had been poisoned by plants, exhibited and accompanied by sketches, called the Rattle Weed, Pompous Pea, Pop Pea, or Menzies' milk, Vetch, (*Astragalus Menziesii*, Gray) of the vicinity of San Francisco, and also quite wide-spread over the State. The fact had been known to himself and to the public for the last ten or fifteen years. How long it has been known to the native Californian he was unable to say, but reiterated experience has taught sad lessons to independent observers everywhere. To some, however, the cause of their misfortune still remained a mystery. He had reason to know that there are also other similar causes, of which more would be said hereafter.

The subject had been frequently brought before the Academy, but as no records had hitherto been made, he thought it proper to suggest that much useful information was often thus lost—was glad to add that no such fault could be attributed to Mr. Yale, the present indefatigable Secretary.

This, and some allied forms, have been figured and published here; so that the public are supposed to be somewhat familiar with it.

The plant has much the appearance of *Bladder Senna*. As no chemical analysis has been made, nor any carefully-noted experiments tried on animals, all we know is the serious results, often obscurely and imperfectly reported by the farmer, ranchero or herder, and the shepherd.

Horses and cattle in this vicinity, he noticed, would shun it so long as the pasture was good, but as it became bare, and hunger impelled, they would eat it, and became narcotized or intoxicated, stagger, and are unsteady in all their movements, act strangely and stupidly, losing their good "horse sense" or common brute sagacity, in short, acting like a *fool;* hence the Mexican name, "*Loco*," given it. At length they become thinner, and cannot be restored to "condition." The brutes get to like the weed more and more, being apparently as infatuated as the Sandwich Islander is for his "Ava," (*Macropiper methysticum*,) in water, which demoralizes worse than ardent spirits, or the drunkard for his bottle. If only slightly "*locoed*," the animal, to a great extent, becomes unfit for uses, except the simplest kind, being unreli-

able in perilous paths or ordinary emergencies, acting so like a fool, to the shame of all sensible animals.

What is most remarkable with this, and the Colorado *Loco*, is the permanence of the impression, often lasting many months, or even for years, half demented, until at length they die. Death often supervenes suddenly; the effect is similar with horned cattle and sheep. The allied *Tephrosia*, or Devil's Shoe-string of the south, although it stupifies and intoxicates, yet the impression soon wears off. This species of Rattle Weed is by no means confined to damp ground, but thrives well on dry hills and all soils. The stem is tall and leafy, growing in bunches from a perennial root, leaflets many-paired (twenty or more), stipuls at base of the leaves trianguloid, membranaceous flowers dirty pale yellowish or whitish, tinged with red, bent forcibly back. Pods inflated, about two inches long, and thinly membranous, indeed so bladder-like that boys amuse themselves by popping them—hence the name "Pop Pea."

Lambert's milk-vetch, of Colorado Territory, *Oxytropis Lamberti*, Pursh; (*Astragalus Lamberti*, Spreng.) consists of about six to eight varieties, which, for all popular purposes one description might suffice. The root is perennial, stemless, or nearly so—not considering the flower or fruit-scape, as such—they grow in tufts or stool-like suckers, springing out by very short branches from the root-crown—are more or less silvery, satiny-silky in every part; the common leaf-stem is about three inches long, the upper oddly pinnate portion the same, or whole length of leaf about six inches, or much shorter than the flower scape stem; pea-blossomed flowers, purplish, blue and white, violet, etc.; leaflets five to fourteen pairs, usually about eight or nine; stipular appendages at the base of the leaves, at, or under the soil, sheathing; pods white, satiny-silky, with very short close-pressed hairs, erect, somewhat cylindric, one-half to an inch long, sharpening out at the point, and partly two-celled.

Found from Saskatchewan to Texas, New Mexico, west to Rocky Mountains, and Colorado to Washington Territory, and, in the opinion of Hooker, to Arctic America and Labrador.

Of this species of "*loco*" we have no personal observation. Asst. Surgeon P. Moffatt, U. S. A., writing from Fort Garland, Colorado Ter., says: "Cattlemen inform him that the weed abounds in damp ground; he is assured that after eating it the animal may linger for months or years, but they invariably die from its effects. The animal does not lose flesh apparently, but totters on its limbs, and becomes crazy. While in this condition a cow will lose her calf and never find it again, and will not recognize it when presented to her. The eyesight becomes affected so that the animal has no knowledge of distances, but will make an effort to stop, or jump over a stream or an obstacle while at a distance off, but will plunge into it, or walk up against it on arriving at it. The plant pointed out to him seemed related to the Lupin."

The members were notified that the appointments of corresponding members would be made shortly, and those desiring to present names could do so by leaving their lists with the Secretary.

wedge-shaped. Color dark brown, tentacles darker. Surface thickly studded with paler tubercles very regularly arranged in front, less so behind the shell. A deep furrow at upper edge of foot, which spreads to twice the width of the body, forming a sharp edge all around. Head obtusely rounded, tentacles long and slender.

It resembles that of *H. Traskii* most nearly, differing much from the others nearest allied in their shells.

A remarkably flat variety of *H. fidelis*, found by Mr. Harford at Dalles, Oregon, is so much like forms of this species as to suggest that they are of a common origin. If the animal proves to be intermediate in colors, it will show that they are only varieties of one species, but so far as known, the animals are more distinct than usual in shells no nearly allied.

H. Traskii Newc. Specimens from near San Buenaventura, where it abounds in moist bottom lands, have the young shell bristly up to the growth of four whorls, but the adult shows no trace of this. The animal has the form of that of var. *Diabloensis* (figured in Proc. Phil. Acad. 1872), but differs in paler purplish (not slaty) tint, and tubercles tipped with white, probably only a more southern variation. The young shell is also distinctly subangled, though not always to the same degree, some being far flatter above than others. Out of over fifty adult shells, one measures 1.30 by 0.60 inch, looking like a pale *H. fidelis*, with but 6½ whorls. I found them to be in the habit of climbing small willow trees in a swamp up to a height of 12 feet.

Dr. Yates has found var. *Diabloensis* in Colusa Co., 100 miles north of Mt. Diablo, near Cache Creek, the outlet of Clear Lake, inhabiting only the eastern ridges of the coast ranges as farther south. Also near Calistoga, Napa County. The supposed hybrid mentioned by me in these Proceedings, III, 331, is the type of this form.

H. fidelis var. *infumata* Gld. In a former article, I have stated that specimens from Humboldt Bay are intermediate between the northern and southern shells; also suggesting that the latter might sometimes show the normal bands of the group. I have verified this suggestion by finding a young faded specimen two miles east of Oakland, in which the darker band is quite distinct just above the angle, on several upper whorls, the light marginal "fillets" also showing above and below it This specimen is also roughly ribbed and clouded above, exactly as in *H. lapicida* for which it might be taken if found in Europe.

It will be observed from the description of the colors of the animal here given, that they resemble those of *fidelis*. All the species analogous to "*Campylæa*" differ much more in animals, as well as in shells, than the "*Arionta*" group. This is connected with their extensive range in latitude, while the latter are limited to more constricted circles, as shown in the article on the "Law of Variation."

The animal is black, with brick-red tubercles, conspicuous even to the end of the tentacles, the furrows of the back not quite symmetrical, except one on each side of the median dorsal line. Mantle edge smoky gray. Length twice the diameter of shell; height of body half the breadth of foot. Form and tentacles more slender than in the polished species; tail sharper. The

slender elongated form is always connected with many whorled species, having a rather narrow aperture in the shell.

Specimens from Alameda Cañon, about lat. 37° 30′, its most southern known range, have the scaly epidermis as much developed below as above. As in bristly species this roughening seems to aid in concealing the shell by retaining a coating of mud.

Mr. G. W. Dunn has found many of this species on the branches of Buckeye trees (*Æsculus*) near Baulines Bay, showing another resemblance to its ally *H. fidelis*.

Dr. Yates has found it near Calistoga, Napa Co.

I have also found banded young of all ages under the loose bark, up to 20 feet above the root of a dead tree, at Haywards.

Glyptostoma Newberryana W. G. Binn. In the Amer. Jour. of Conch. V, 190, Bland & Binney call this a "true Helix," but from their description of jaw and teeth merely prove that it is neither a *Macrocyclis* nor a *Zonites*. Since then they have made it the type of a subgenus *Glyptostoma*, from the grooves in aperture. According to the Agassizian rule, the external form of the shell is enough to separate it from the same *sub-family* with any type of *Helix*. The animal differs materially also as follows:

Length 1½ times the width of shell, spiracle just above middle of its back when creeping, only ¼ inch from angle of aperture. Granulations very long and coarse, reticulately furrowed between, and one straight furrow running obliquely down from spiracle toward mouth on right side of body, about five furrows above, and five below it. A distinct furrow around flattened margin of foot, with branches connecting it with another close to edge. Tail flattened and obtusely wedge-shaped without mucous gland. Eye-pedicles nearly one-third of length of body, and like lower tentacles, finely granulated. Foot *narrower* than height of body. Color smoky gray, foot paler beneath, edge of mantle yellowish.

The form of the animal is indeed almost the same as in our species of *Macrocyclis* (and this of course is connected with the similar form of the shell), but the external characters otherwise differ as well as the jaw and teeth.

Genus MESODON Raf. Rafinesque's "General Account, etc.," 1818, mentions as found in Kentucky, of "Helix four species," while his descriptions of *Mesomphix*, etc., distinctly state that he considered the typical *Helix* imperforate, no doubt adopting the type of his friend Risso (and of Leach?), viz.: *aspersa* (="grisea L." teste *Hanl.*) Taking W. G. Binney's list of species of the "Interior region," it is easy to identify the four nearest to that type, viz.: *albolabris, multilineata, Pennsylvanica, Mitchelliana*. His "twelve species of *Mesomphix*" include some of *Macrocyclis, Zonites* (and *Patula?*); his "*Trophodon*, ten species," must include the "*Odotropis*" of next year. Both are from the same Greek words, meaning "toothed whorl." From his later "Enumeration, etc.," 1831, it appears that he divided *Trophodon* into three groups, giving the name "*Mesodon*, 1819," to the first, though it is known only as a catalogue name, the *M. leucodon* of that date. The description "Differs from *Helix* by lower lip

with a tooth. *M. maculatum*. Depressed, five spires, hardly striated, upper lip reflexed, tooth careniform. Fulvous with brown spots," agrees best with *multilineata*, for he does not state that it has a tooth "on the spire," as in *Odotropis*, but a "careniform" ridge on the *lower* (not "inner") lip. Thus Mr. Tryon's statement that he figured *albolabris* as type in Mss. is intelligible, showing that the tooth referred to was not on the parietal wall as usually understood.* We must then suppose that he made the genus to include the species he before placed in *Helix*.

It appears most proper, if we adopt any of Rafinesque's names, to use those published before 1825 in preference to later ones, invented after his mind became affected. His earlier writings are as clear as those of most naturalists of his time, and from his allusion in some places to unjust suppression of his descriptions in Europe, we may suppose he would have done better after 1825 but for his unhappy condition. On this account the name *Odotropis* having an excellent description given with it would be far preferable, if he had not unfortunately omitted to mention a type species. As it is, it can only be used for a section, as done by me in 1868.

As to the distinctness of this genus from Helix as defined before, there can be no doubt, and it is still more different from the *Pomatia* group. The large, typical species all differ definably in shell, jaw and lingual teeth, as well as in the form of the animal, which has the foot less expanded. The nearest approach to Helix, in shell, is seen in *O. multilineata* and *O. profunda*, but their bands and jaws are quite different. As subgenera it includes *Aplodon* Raf., *Polygyra* Say?,† *Stenostoma* Raf., *Triodopsis* Raf., *Dædalocheila* Beck.

Mesodon Raf. only differs from *Odotropis* in absence of a parietal tooth and of umbilicus, and *Ulostoma* is synonymous with *Mesodon*, having a tubercle on the lower lip. *Trophodon* Raf. is doubtfully distinct, connecting *Odotropis* and *Triodopsis*, while *Xolotrema* includes only the imperforate species of the last, connecting it with *Stenostoma*.

The lip and teeth alone furnish only subgeneric characters, and the umbilicus is scarcely of specific value. While some of the above divisions approach nearer to *Helix* in internal characters, their shells are still more different.

M. Townsendiana var. *ptychophora* A. D. Brown, Journ. de Conchyl. 1870, p. 392. = *H. pedestris* Gld. (part, animal excl. smooth var.) 1846.

= *H. Townsendiana* var. Bland & Cooper, Ann. N. Y. Lyc. VII, 362, and var. *minor* Tryon, Mon. Terr. Moll. of U. S.

Hab. Montana and Nebraska, Rocky Mts.

It seems yet unsettled whether this species belongs to *Arionta* or *Mesodon*, and I have been unable to obtain living specimens for comparison. Mr.

**Mesodon* Raf. (1819?) 1831, type *H. thyroidus* Say, *teste* Ferussac (from specimens?), *albolabris teste* Tryon from Raf. Mss. "Type *elevata* Say," *teste* Gray, but this was probably a type of *Trophodon* 1818, which differed in the "upper lip notched." Gray, however, followed the strict rule of adopting the first recognizable species named in Ferussac's catalogue

= *Odomphium* Raf. 1831 (umbilicate group of *Mesodon*).

Raf.'s Mss. figure of "*M. leucodon thyroide*" is certainly *thyroidus*, but called "spotted," and the trinomial term used indicates that it was not his original type.

†This name though anterior, is inapplicable to all the species.

Binney's latest work states that its lingual dentition differs from the other known *Ariontæ*, approaching the last-named genus.

M. anachoreta W. G. Binn. Compare "*H. læsa* Rve." Conch. Icon. *Helix*, Pl. CCX, described as "granulated, *Hab.* unknown."

Subgenus APLODON Raf. "Differs from the genus *Helix* by its rounded mouth, one-toothed columella, and umbilicus. One specimen in Kentucky, remarkable, *A. nodosum*. Three whorls of spire embossed, and lightly wrinkled concentrically beneath" (Journ. de Physique, 1819). The rounded mouth also distinguishes it from *Stenostoma** and there seems to be no species in Kentucky to which it can apply, except a variety of *monodon*, common in the west, retaining the embossing left by the bristles of the young (*Helix Leaii* Ward). That species forms a link between the subgenus *Stenostoma* and the more different group of *Odotropis* , to which I applied it in 1868.

Our two species are so closely connected as to be hard to separate, and one, the *germana*, has often, if not always, the internal tubercle characterizing most of the subgenus *Stenostoma*. They agree with *O. monodon* in fewer ribs on the jaw than in the type forms.

Mesodon (Aplodon) Columbiana Lea. The uncertainty of the difference in the jaws of this species compared to that of *germana* (as described and figured by Bland & Binney in Ann. N. Y. Lyc. N. H. X, p. 304, pl. xiv, f. 2 and 4) is shown by jaws extracted by myself from shells that would probably be all considered *Columbiana* by those authors.

1. A Sitka jaw is strongly arched, with eight broad ribs.
2. S. F. specimens have nine or ten ribs, stronger, but narrower.
3. A Santa Cruz specimen (toothed and imperforate) has them similar, thus exactly filling the gap between B. & B.'s jaw of *Columbiana* with eight narrow ribs, and that of *germana* with eleven broader ones. The proportions they give for the soft internal organs are very unreliable, as alcohol produces very different forms in those of the same species, and they even differ in individuals with season and age (see *Prophysaon*). I am, therefore, compelled to consider *germana* as only a variety of *Columbiana*. This species has been found near Calistoga, Napa Co., by Dr. Yates, with *Vancouverensis*, *infumata* and *Diabloensis*, associated at no other locality.

M. (Dædalochila) Harfordiana Cp.†

I have heard of what was probably this species in the mountains east of

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*This name, used in 1818 and 1831, was evidently intended to include *Stenotrema* described in 1819, that name having been pre-occupied in 1815, and being as applicable to "narrow umbilicus" as "narrow mouth." Raf.'s type *convexum* is prior to Ferussac's name, and his manuscript was probably altered in Europe before printing.

† Genus GONOSTOMA Held. This European form, type *obvoluta*, is connected with my *Ammonitella Yatesii*, by the "*Drepanostoma nautiliformis*" Porro, of Italy, but the three species are different enough, apparently, to form three subgenera. "*H. ammonitoides* Rve." of Australia, is still more like mine in the form of the mouth, but highly colored. The animals of all need thorough comparison, and also with similar concave shells from the Pacific islands. Those who unite mine to Helix should call it "*H. ammonitella* Cp.," there being a *H. Yatesii* Pfeiff. 1855.

San Diego. Mr. Hemphill also informs me that he collected it in Idaho, thus approaching the range of allied *polygyrella*.

Genus PATULA Held. Type "*H. radiata* Penn." (or "*H. alternata* Say.," teste Gray, Genera.)

This genus was founded on one of the group of "*Anguispira*" Morse, a name used by me in the "West Coast Helicoid Land-Shells," but according to Bland & Binney includes also *P. Hornii*" Gabb, and *striatella* Anth., with var. *Cronkhitei* Newc., though not the others I included in it.

P. solitaria Say. Compare "*Helix Kochi*" Pf. Monog. I, figured by Reeve, Icon. Pfeiffer places them close together, but the habitat was unknown. If the collector was the Dr. Koch of "Sea Serpent" fame, he no doubt collected it in Osage Valley, Western Missouri, where he exhumed Mastodon bones. The figure looks like one of the varieties of *solitaria*.

Patula pauper Morio. (not Gould) Alaska. "*Helix ruderata*" Stearns, Proc. Cal. Acad. III, 384 (not of Studer). "*Patula ruderata?*" Cooper, Amer. Journ. Conch. V, 202.

Genus MACROCYCLIS. The animal of the tropical type of this genus seems to need comparison with the northern forms. By strict rules, the name Mesomphix belongs to this group, the type being plainly *concava*, as shown by Ferussac.

M? "*Helix*" *Belcheri* Pfeiff. 1, Reeve, Icon. Compare this with the Alaskan form called "*Vancouverensis*," but which seems different. The locality of Belcher's specimen was unknown, but he visited that coast.

M. Voyana Newc. Found rarely in Alameda County, by Dr. Yates and H. Hemphill, common and large near S. Diego. The animals show the following differences:

1. Alameda Co. Dusky white, back purplish-brown, a distinct dark stripe on each side, running back from base of eye-peduncles, which are whitish-brown.

2. San Diego. Yellowish-white, middle of back, stripes and tentacles all pale slaty.

3. San Francisco specimens (called "*Vancouverensis*") are darker yellow than the last, with no central or dark stripe. They thus agree closely with the description of the animal of *A. concava* by Dr. Binney, but differ much from that of Oregon *Vancouverensis* as described by him and by Dr. Newcomb, in Amer. Journ. of Conch. Vol. I.

The animals of Alaska specimens, with a greener shell, are paler than all the others.

M. Durantii Newc. = *Patula Durantii* of former papers. According to Bland & Binney this little species shows the same disregard for generic uniformity of size seen in *Patula*, *Zonites*, *Hyalina*, etc., and makes the terminal member of the series on this coast represented by three or four species, regularly diminishing in size.

I have lately found it in one spot (on limestone only), two miles from Oakland, so that its name, from the late President of the University of California, is more appropriate than when given (see these Proceedings, III,

118). It was also found several years ago by Mr. Rowell, at Haywards, also in Alameda Co. I have not found it there, where, however, occur the following mollusca: *Helix Californiensis*, typical, *H.* (var.) *infumata*, *Triodopsis loricata*, *Mac. concava*, and all the species without shells common to California.

Punctum pygmæum Drap. This most minute of our species has lately been found, also, near Haywards, by Dr. Yates.

Succinea lineata W. G. Binn. The specimens from Mojave River mentioned by me in Vol. IV, p. 151 as probably *S. rusticana* Gld., are more likely to be *lineata*, as I found this west of the first locality along Santa Clara River, down to within 8 m. of San Buenaventura. The animal is yellowish-white, paler beneath, eye-tentacles dark, with a dark line running back in the animal's head from each. Shell honey-yellow, thick enough to hide the colors of animals.

S. Sillimani Bland. The Mojave R. specimens mentioned with the above as *S. Nuttalliana* Lea, are probably the present species for the reason just mentioned, this having been found by me in the same swampy thickets. The animal is quite different from that of the last, being lead-color, paler beneath, but showing also the dark lines in and behind tentacles. The shell is greenish, and so thin that the viscera show through it, but is nearly always so encrusted with mud as to partially conceal it. I have noticed the same habit in *S. Stretchiana*, the mud being evidently plastered on in ridge-like layers by the animal itself.

Hyalina arborea Say. Not rare with the *Succineas*, the only place where I have found it near the level of the sea in Southern California. Constant moisture and summer fogs, are found in few other locations southward.

Genus PROPHYSAON Bland & Binney, 1873, type "*P. Hemphilli*" B. & B., Ann. N. Y. Lyc. X, 293-297, Pl. XIII.

The authors remark that they had only compared alcoholic specimens with my description and figure of "*Arion Andersonii*" (Proc. Phil. Acad. 1872, 148, pl. III, f. F). I have compared *their* description and figure with alcoholic specimens of my species, and find that the differences mentioned by them are caused chiefly by the contraction by the alcohol. The distinct locomotive disk, minute caudal pore, and position of generative orifice, all become changed as described by them. The jaw figured by them differs only in being immature, and in some of the ridges being consolidated, thus showing eight single and six double ones, making twenty, as given by me.

This difference, with other possible distinctions in color in fresh specimens, may be sufficient to separate their species by the name of *P. Hemphilli*. Mine is, however, of the same genus, and though I had before suggested a name for it in Mss., I am willing to adopt *Prophysaon Andersonii*. It is not unlikely that the Oregon animal may be the "*Arion foliolatus*" Gld., still imperfectly known. My species is common in winter along the large creeks east of San Francisco Bay.

Ariolimax Californicus Cp. In the dry season these animals crawl down into deep fissures made by the sun in some soils, or hide on the northern exposure of cañons on streams, in cellars, etc., where some can be

found all summer within ten to twenty miles of the coast. At a place near Oakland where the kitchen-refuse of part of the town is dumped, near a swampy spot, they come out in hundreds to feed on the rotten vegetables, etc., emerging about 4 P. M. up to June, when fogs prevailed, but not until sunset in August. A few *L. campestris* inhabit the same spot, but remain in the wet grass only.

A. niger Cp. This, described with *P. Andersonii*, I have since found once near Cypress Point, Monterey, as well as in several places within the range given before. Near Oakland it does not appear until the ground is well soaked with rain, about November, and deposits its eggs in December to February. It does not occur in gardens, but in uncultivated oak-groves on clay lands.

"A. Hemphilli W. G. Binn., lately described from Niles Station, Alameda Co., seems externally only like a pale var. of *A. niger*.

Limax (Amalia) Hewstoni Cp. In our Proceedings IV, p. 151, 1871, I referred to this as "another new species of *Limacidæ*," being uncertain whether it might not be imported, as I found it only in San Francisco. It certainly agrees nearly with the too brief description of *L. Sandwichensis* as well as the figure, in Voyage of the Bonite, II, p. 497, Pl. 28, f. 8, but comparison of living specimens will be necessary. Mr. Binney in Ann. N. Y. Lyc. XI, 22, states that specimens of an *Amalia* were sent to him by Mr. Hemphill from Los Angeles, and though differing in its dentition, thinks it indicates that the genus is native to California.' I am more inclined to think some species has also been introduced there with orange trees, grape vines, or otherwise.

My reason is, that I have searched carefully for these animals in Southern California since 1871, and found only *Limax campestris*, which is common near San Buenaventura, and occurs south to San Juan Capistrano, while I found none in the mountains or valleys near San Diego, and no *other* one at Los Angeles.

This species has apparently succeeded in establishing itself in spots on the east side of S. F. Bay, where the climate is much drier than in the city. I have found it only in one very damp garden in Oakland, and in some 12 miles east of there, while outside of cultivated gardens, even where always moist, it does not occur.

Alexia (myosotis var.?) *setifer* Cp. Since my first notice of this species, it has been nearly exterminated in Mission Creek, by street crossings and obstructing the tidal flow, so that I have lately found it only in one spot near the mouth. It may, however, remain more scattered in Mission Bay, though so exceedingly tender that it has died in every other locality where I have tried to colonize it. The name given in Vol. V, p. 172, as "*Melampus ciliatus*" should be Auricula ciliata *Moricand*.

Ancylus crassus Hald? A specimen received from Humboldt River, Nev., by Dr. Yates, appears to be a thin variety of this, approaching "*A. Kootaniensis*" Baird, and thus connecting the latter with former, as I doubtfully placed them in these Proceedings, IV, 101, 1870.

On p. 174 of same volume, I referred specimens from Spokan River to *A. patelloides* Lea, by mistake for *A. crassus*.

Gundlachia Californica Rowell. Two specimens found by me in a little sandy rivulet at Baulines Bay, appeared to be merely the common *Ancylus fragilis*, but some months after, in taking out the animal, I found that one had a "deck" covering nearly its whole aperture, exactly as in the "young of *G. Stimpsoniana*" figured by S. Smith in the Ann. N. Y. Lyc. May, 1870. The other, though exactly similar above, is an *Ancylus* below! That from Merced Falls, mentioned in our Vol. IV, p. 154, differs in being much smaller and paler, as were the *Ancyli* found with it. Mr. Smith states that the animal of his was exactly like that of *Ancylus fuscus*, and Dr. Stimpson described the dentition as similar also, to that of *A. rivularis*. These facts seem to show that the forms called *Gundlachia* are only modifications of *Ancyli*, analogous to the thickening of lip observed in Physas that survive a winter or a dry season. Some individuals, better nourished than others, secrete so much shell as to nearly enclose themselves in their first year's shell. In the following year they may continue to form shell, and thus make a *two-storied Gundlachia* from a one-storied *Ancylus*. Thus we see why the specimens of the former so much resemble those of the latter found with them, in the respective localities of each so-called species.

Limnophysa Binneyi Tryon. Many specimens of this fine species were found by Mr. Dunn at the Cascades of the Columbia, with a *Physa*, apparently a large var. of *P. diaphana*.

Pomatiopsis intermedia Tryon. Found once near Clear Lake by Dr. Yates, and by me in a small spring near Saucelito, Marin Co., the last proved by the animal.

Bythinella Binneyi Tryon. I have found what I suppose to be this near the summit of "Black Mountain," Santa Clara Co., over 1,500 ft. alt., in a cold mountain rivulet. Others from branches of Alameda Creek found by Dr. Yates, differ entirely in the animal from that of *Pomatiopsis*, but it externally resembles closely that of *Amnicola*, of which this is scarcely more than a subgenus.

Cochliopa Rowellii? Tryon. Two fossil specimens from post-pliocene beds near Green Valley, Contra Costa Co., are so much like this species, as figured, that it may still exist in California, even though found at Panama also, as Mr. Tryon believes, from specimens received. Several Central American fresh-water shells seem to be identical with the northern, and a Tropical American *Pompholyx* is described as closely resembling that of California.

Hydrobia Californica Tryon. After long search I have found specimens of a true *Hydrobia* in a very limited station at the head of a brackish creek on the south side of "Lake Peralta," Oakland, where they occur on floating sticks. The shell described by me in Proc. Acad. Sc. Phil. 1872, as *Assiminea Californica* "Tryon," and mentioned in these Proceedings,

IV, 173, is quite distinct, and inhabits the outlet of the same creek abundantly, ½ mile lower down. They must be distinguished as follows:

A. Californica Cooper (Tryon in part?). Dark horn-brown, shining, acute, whorls rapidly increasing, and flattened on spire, a slight parietal callus, not connecting lips. Animal whitish, tentacles and muzzle tinged black, a rufous patch on top of head, its foot ovate, twice as long as shell; tentacles oculiferous, two.

H. Californica Tryon (emend., figure and part of description). Shell nearly white, translucent, rough, rather obtuse, whorls slowly increasing, and very convex, mouth subovate, lip nearly continuous, leaving a slight notch in umbilical region. Animal white, top of head and tentacles (four) yellowish, a black jaw (?), visible in proboscis. which is very extensible; foot with pointed lateral lobes in front spreading sideways, tapering to a long acute point behind, tentacles long and sharp, the eyes at their base; foot 1½ times the length of shell—proboscis half its length, tentacles about as long.

The animal of *Hydrobia* is much more active than that of the former, and easily observed in a bottle of water taken from its peculiar station.

Regular Meeting, February 15th, 1875.

The President and Vice-Presidents being absent, Mr. Stearns was called to the chair.

Eighteen members present.

Donations to the Museum: From Mrs. F. F. Victor a collection of shells from Modoc Lake, on the northern border of California. Henry Hemphill donated sundry reptiles and crustaceaceæ, (not identified); from W. Russel a mole-cricket; from Dr. Kellogg a specimen of *Pinus muricata* from Santa Cruz, illustrating the enlarged umbos when much exposed to the winds of the coast, also cones of *Pinus monophylla*, one of the most nutritive and delicious of all the piñones. From F. Gruber, the following birds: *Perdix cinerea*, or European Field Partridge; *Ampelis garrulus*, or wax wing; *Alauda brachydactyla*, or Crossbill; *Fringilla Coccothraustes*, or Grosbeak; *Oriolus galba*, or Golden Oriole.

The Secretary read a paper from Professor George Davidson, as follows:

Abrasions of the Coast of Japan.

BY GEORGE DAVIDSON.

In approaching the coast of Japan on the voyage from San Francisco, there is opportunity for seeing but a very few miles near the southern eastern point of the entrance to to the Gulf of Yedo. This we made before daylight, and so far as I could make it out, there was no feature resembling the well marked terraced points and capes met with on the northwest coast of North America.

The surface features of the coast are nevertheless well marked and distinctive, reminding one of parts of the Pacific coast of Mexico, and of parts north of latitude forty, except the absence of the heavily timbered slopes and summits. On the coast of Japan the hills rise steeply to elevations reaching two and three thousand feet, and are either cultivated or covered with a dark green chapparal, with occasional limited masses of small timber. There are no indications of broad deep valleys, but mostly of short narrow valleys with sharply sloped sides.

After entering the Gulf of Yeddo the only terraces I could detect are at Cape Canon, on the western side about twelve miles south of Yokohama, and at a the part of the Gulf where a moderately sharp contraction of the width of the Gulf takes place. At this point are exhibited some of the characteristics of the terraced points off our Pacific Coast. The coast-line is of quite recent formation; the stratification somewhat distorted, and has a moderately large inclination; but the surface of the contracted terraces is parallel with the sea-level, and has evidently been planed off by the Glacier which moved along the face of the sloping higher land. On the surface of these terraces lies a thin layer of soil which is cultivated.

Upon leaving Yokohama for Nagasaki I had another opportunity of examining this terrace and confirming my previous judgment. Thence to Oō Sima, the coast line was passed in the night time until we made Ise Bay, where the high, broken and dark outline of the coast hills is seen. Every hillside is covered with dark green chapparal and small timber; the hills reach two thousand feet elevation and give no indications of extended valleys. Skirting along this coast in moderately thick weather we saw no terraced shores until we neared the promontory off which lies the island of Oō, with its lighthouse, in latitude 32° 25′. Here were unmistakable evidences of terraced coast line, not in one or two cases, but for miles to the northeast of Oō Sima (*a*), and especially in the island itself. The single terrace of this island is very well marked parallel to the sea-level, and is about 100 feet above the water. When abreast of it several slightly projecting terraced points are seen along the coast to the northeastward, and also on the coast immediately abreast of the island. But I did not see the terraced lines along the north-

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(*a*) Sima = Island.

west coast line of this promontory, even in the vicinity of Oö Sima. Bad weather and night shut in further opportunity.

This promontory forms the eastern shores to the eastern entrance to the great strait, called the inland sea of Japan, through which we passed for two hundred and fifty miles, enjoying some of the most enchanting views I have ever seen, reminding me forcibly of the great inland waters from Puget Sound to the Chilkaht River, but enlivened by hundreds of junks and fishing vessels; shores lined with villages; steep hillsides terraced for cultivation to heights of nearly one thousand feet, wherein the numerous terrace walls would certainly form a total height of four hundred feet, as I have verified here. Some of the passages are tortuous, narrow and deep—through high islands or between steep fronted capes. Cultivation on every spot where even five hundred square feet and less can be terraced. No heavy timber; sparsely distributed patches of small timber; large growth of chapparal on the higher and steeper parts of the hills. The mountains rise to elevations of probably 3,000 feet, but the average height of the outline will be about one thousand feet. Again no indications of valleys except of the most limited character.

I looked in vain through all these shores for signs of terrace formation. So along the outer coast and through the islands from Simonoseki strait to Nagasaki, the hills preserved their characteristic outlines and shapes, except Table Mountain, fifteen hundred feet high and lying a few miles west of Nagasaki.

Here I have had ample opportunity to judge of the general geological character of the country. It is of the most recent formation, has been violently distorted by pressure from below, and then eroded into its present irregular surface. I have looked occasionally for local traces of glacial action in some of the harder materials, but failed to satisfy myself beyond doubt.

But of the glacial action at Cape Canon, and at Oö Sima, and the adjacent coast, I have no doubt whatever; but in both cases I could trace but one terrace, and that at Oö Sima had an elevation of one hundred feet.

I have communicated this short note to the Academy as an additional evidence to what I have already given of the abrasions of coast line by the action of glaciers bordering them.

The Secretary also read a paper from Professor Davidson, as follows:

Note on the Probable Cause of the Low Temperature of the Depths of the Ocean.

BY GEORGE DAVIDSON.

In my first note upon the "Abrasions of the Continental Shores of Northwest America, and the supposed Ancient Sea Levels," I attributed these abrasions to the action of a great body of ice contiguous to the whole line of our coast, and which moved along the coast line either by the combined forces

of ocean currents and the pressure of the greater masses from the northward; or as part of the great ice sheet that covered the continent and moved slowly southward.

As a glacial mass it extended seaward many miles, as indicated by its action upon the islands which I therein named. And it seems not only possible, but highly probable, that this great ice sheet not only covered and bordered the continent, but that it projected far into the oceans; *and not improbably may have occupied a large part thereof!*

We know its effect in the terracing of the rocky coast of Northwest America; and in cutting the channels through the Santa Barbara Islands; and still further, I believe we see other *effects of its existence and extent in the present nearly ice-cold temperature of the great depths of the ocean!*

The theory which attempts to account for that low temperature by the transfer of Arctic waters to the depths of ocean utterly fails in the case of the Northern Pacific Ocean, where the narrow contracted throat of Behring Strait not only could not give egress to such a volume of cold water in millions of years, but is actually the channel for the passage of the Kamschatka branch of the Japan warm stream into the Arctic basin. A small thread of the Arctic waters does pass through Behring Strait, but it is of very limited section, for the strait itself has a section of only thirty miles in width by twenty-five fathoms in depth.

The more that I have looked at the discussions of the theory of the intercharging heated surface waters of the equatorial regions with the cold waters of the Arctic basin, the more strongly I am convinced of its weakness and insufficiency. And in searching for the cause of the nearly ice cold waters of the ocean depths, the proved former existence of the great ocean coast ice belt, and probably of ice masses occupying the high northern and southern areas of the oceans, have seemed to me sufficient to account for the low temperatures which deep sea explorations have proven to exist.

Dr. Kellogg read a paper describing the different varieties of Eucalyptus, with their characteristics.

Different Varieties of Eucalyptus, and their Characteristics.

(Letter to Mr. Ellwood Cooper, of Santa Barbara.)

BY DR. A. KELLOGG.

According to promise, I collate a few brief notes on *Eucalypti.** As you have Dr. Mueller's work I need not quote from it, but give such information as can be obtained from other sources. For the medical properties of extracts, etc., I refer you to the Doctor.

I wish to say, first, that I know of but *two trees* (which now occur to me) that are perfectly proof against the *Teredo navalis*, or pile-borer of tide water,

* There are one hundred and thirty-five species. A long time may elapse before a thorough knowledge of these and their numerous varieties are fully known.

or their like. These are the Palmetto (*Chamærops palmetto*) of our southern coast, and the Yarrah of Australia. There are doubtless many more. (?)

If at any time you visit the city, we shall take great pleasure in showing specimens of timber that have been tested, now in the collection of the California Academy of Sciences (of which your correspondent is Director in charge). So that no one need take second-hand opinions, or the *Ipse dixit* of any one writer, author, or personal friend. This much is due, by way of introduction. And further, we need to be cautioned against considering that any one knows it all. Much experience and careful experiment is yet requisite; I trust, however, that thorough tests of all timbers, native and cultivated, will, ere long, be made, either at our State University or the Academy.

If I am right, the common *Eucalyptus globulus* (of which you cultivate so much) is not an Australian Gum at all, but Tasmanian—New Zealand has none; if wrong in this impression, I will write again. *E. globulus* is greatly infested by beetle borers when transplanted into parks in Australia. We have a specimen badly eaten by the *Teredo*, but the card attached omits to name the species.

E. rostrata.—This is the famous Yarrah (or by corruption, Jarrah of some. It should be noted that this name is applied by the natives, and vulgarly, to almost any tree). This specimen is also called Flooded Gum, Red Gum, or White Gum—described as a striking object on the landscape—so wild and picturesque; its huge, gnarled or coiled branches—shining bark of white or light red—contrasting with dark masses of foliage above, and glancing shadows below, produce peculiar scenic effects of the wildest forests, awakening the ideas of grandeur, as the lofty object lifts its signal flags high over all the trees; inspiriting the thirsty, weary and worn traveller from afar with the living assurances of water.

This is the true species that has proven so perfectly proof against the white ant and beetle borers; and altogether impervious to the *Teredo* that infests the piles of our wharves. A specimen of this timber, presented by Mr. I. C. Woods of this city, has stood the best of actual trial, as here seen.

This is also largely used for railway ties, etc. The wood is solid as iron; specific gravity 0.858 to 0.923 or variable, and does not always bear so good a character—climate, soil, etc., have much to do with the quality of this and all timber, as we know full well. A large tree, along streams or adjacent to water.

E. tereticornis.—Called Gray Gum, often Red Gum or Blue Gum, and sometimes Bastard Box—a very variable species. Flowers generally seven in a cluster; seed box has a broad rim, the valves protruding. The wood is good for posts and rails, or as fuel—has a beautiful grain like oak—takes a fine polish, and whether exposed or not is durable. Used where the Iron Bark cannot be had.

E. punctata.—This is mostly termed Hickory or Leather Jacket; has rather spreading habit; is exceedingly tough and durable; fine for fencing, railway sleepers, and for fuel. The rim of this seed-vessel is not so broad, nor valves so prominent; there are several varieties.

E. Stuartiana var. *longifolia*, is the Yellow Gum; seldom 80 feet high; timber good; leaves very long; valves of seed-vessel not so prominent as the preceding;

wood only used for fencing or fuel; decays rapidly if exposed; easily killed by a wet season.

E. viminalis.—This is the Manna; also Drooping; called also White Gum; yields manna, and is *remarkable for its elegance;* 150 feet high, 8 feet diameter; not much esteemed. The Gray Gum (*E. saligna*) sometimes mistaken for this, etc.

E. dealbata is one of the so-called White Gums, about 50 feet, without branches, capped with dense foliage, covered with a white powdery bloom (easily rubbed off); bark of a purplish tinge when young, becoming brown with age; wood light color, too soft to be of general use; said to shed its bark every third year.

E. albens is also one of the White Gums; 80 feet high, etc.; wood of little or no use.

E. goniocalyx is one of the most useful; in some districts called Flooded Gum; in others, Blue Gum; chiefly found on rivers and creeks, and is also a forest tree. One mark of this species is the angular calyx—hence specific name; another, the short, flat peduncles (flower-stems) in umbels or clusters of seven flowers on short, thick stems; 80 feet or more, 7 feet diameter. Although the wood varies with soil, it is generally considered highly valuable; several of the Blue Gums of catalogues belong to this species; a tree of rapid growth; specific gravity less than that of any other Gum. The timber is extensively used for building purposes, as scantling, battens, floors, posts and rails, ship's planks, etc. Indicates good soil.

E. dumosa—the big chaparral bush so annoying to travelers.

E. incrassata is another of the small species that together constitute the Mallee Scrub; the natives sharpen and harden in hot embers for digger sticks, like metal; famous for ramrods, etc.

E. uncinata is Dr. Mueller's *E. oleosa*—still another of the above list of Mallee Scrub; the root runners retain a copious supply of pure water for the thirsty.

E. hæmastoma—Mostly known as White Gum, but in some districts the bark has gray patches; hence known as Spotted Gum; little esteemed for fuel or any other use.

E. stellulata—This is the Mountain White Gum; in some districts the bark is lead-colored, hence named Lead Gum; 30 to 40 feet high, and 2 feet diameter; wood of no service, save for fuel; distinguished by veins or nerves that start near the base of the leaves, and run almost parallel to the midrib.

E. coriacea—This is another of White Gums from the Blue Mountains; 40 to 80 feet; not much valued.

E. radiata—The River White Gum (by some considered a variety of the Messmate or *E. amygdalina*). This is a smooth tree with bark often hanging in long strips from the upper branches; it never grows away from water; 50 to 60 feet; timber not valued by the settler.

E. eugenioides—The Mountain Blue Gum; 100 feet high, and much used by wheelwrights and carpenters, but is not equal to *E. goniocalyx*, the Flooded or Blue Gum.

E. gracilis is Dr. Mueller's *E. fruticetorum*; a small tree or shrub of several varieties.

E. Saligna a Gray or Flooded Gum of rather drooping habit and no great size; in low grounds, *near salt water;* although a fine looking tree, sometimes 100 feet in height, the wood is inferior.

E. maculata or Spotted Gum is one of the handsomest; 100 feet and upwards; well defined by its double lid and urn-shaped seed-vessel; some esteem it equal to the English oak, others regard it as fire-wood; used for staves and upper parts of railroad bridges, etc.; grows in poor soils, New South Wales and South Queensland.

E. virgata—Styled Mount Ash (this name, I see, is given to *E. amygdalina* or Messmate in the Government Report of the Secretary for Agriculture of 1874). This is a fine tree, 120 feet high, growing on rocky mountain ridges; makes better staves, good shafts, and all common carpenter work, fences, etc.

E. obtusiflora—An inferior kind of Box or Blackbut; has large flowers, and an ovid blunt seed-vessel; the wood is valueless.

E. pilularis or Blackbut of South Queensland, Gipps Land and New South Wales, is one of the largest and most valuable species of the Gums. A tree of over 46 feet circumference 5 feet from the butt; 150 to the first limb. The wood is excellent for house carpentry, ship building, and, indeed, for any purpose where strength and durability are required; specific gravity 0.897: no species known bears a greater crushing strain in the direction of its fibre; it prefers good soil, and grows rapidly.

E. acmenoides, or White Mahogany, is remotely allied to the above.

E. Bicolor comprises several varieties, called Bastard Box or Yellow Box; this resembles the narrow-leaved variety of Iron Bark; has grey and white patches, hence the specific name; 80 to 100 feet high; when young, smooth above, or half-barked like the Box; older, nearly all the bark falls off; the wood is very hard, good for fencing, shafts, poles, cogs, etc.; exceedingly durable; heavy, but does not split well; as it does not sun-crack, it is esteemed for spokes, weather boards, etc.

E. hemiphloia is the well-known Box. In first-class repute for hardness, toughness and durability; burns brilliantly, and emits great heat, but it is attacked in the ground by dry rot and the white ant; specific gravity, 1.129; shafts, spokes, plough-beams, etc.

E. longifolia, usually called Wooleybut, though in some districts called Peppermint,* on account of the oil of the leaves having that flavor. A very fine tree, with leaves more than a foot long; flowers large, in 3s; seed-vessels best defined of all, ¾ inch long, ½ in diameter, four-celled, valves not protruding beyond the broad oblique rim. The volatile oil of the leaves possess remarkable qualities, but the wood is not much esteemed, save as fuel; it is, however, split for fencing and the like, but not durable; others say excellent; the fibre of the bark is adapted for packing and paper making.

E. diversifolia—A tree of beautiful form, 80 feet high; wood indifferent; buds and seed-vessels small, eight, in axillary or lateral umbels.

E. polyanthemos is a tree of moderate size called *Lignum Vitæ*, Poplar-leaved Gum, or Bastard Box; wood brown towards the centre; very hard and tough.

E. pulverulenta and *E. cinerea*—Two varieties of small tree called Argyle Apple (being similar to *Angophora subvelutina*, or Apple of the Colonists).

E. acmenioides or the White Mahogany; often mistaken for the Stringy Bark (*E. obliqua*, capitella, etc.), but the bark is not so fibrous, nor the leaves so oblique, whilst the specific gravity of the wood is much greater; found near the coast; timber useful for building purposes, palings, etc.; when nicely planed, has an ornamental appearance.

E. robusta is the Swamp Mahogany, a very large tree; over 100 feet, and 5 diameter; in low marshy places; seed-vessel more than one-half an inch long, the capsule deeply sunk; in young trees the leaves are large and glossy. The wood is not considered durable, though people differ in opinion; used for rough furniture and inside work, ship-building, wheelwrights, and for mallets, etc.

E. botryoides is the Bastard Mahogany of workmen; it grows in sandy places near the sea. A tree of gnarled and crooked growth of no great height; used for fuel, knees, etc., of vessels.

E. resinifera, often called Red and Forest Mahogany; the first name is taken from the color of the wood, the other from being found in forests remote from the coast. The wood is very strong and durable, and is used extensively for fencing, beams, rafters and rough work; specimens of sound wood that had been fifty-four years in a church were taken down and sent to the Paris Exposition.

E. corymbosa, or Bloodwood, from the color of the resin that exudes from between the concentric circles; inland species; 120 feet; for fences and firewood; of rapid growth; the wood is soft, especially in young trees; becomes

* This we take to be the far-famed fire-proof shingle tree; sparks can only burn a hole through, but it will neither flame nor spread; splits to a charm.

harder in age; said to stand well in damp ground; some affirm its great strength and durability; seeds winged.

E. eximia is the Mountain Bloodwood; Bentham thought this species more nearly allied to *E. maculata* or Spotted Gum than to Bloodwood; flowers large, corymbose; the operculum or lid is double, the seed-vessel is urn-shaped, nearly an inch long; top of capsule deeply sunk.

E. stricta is a shrubby species; fine linear leaves; forms thick brushes; it is the *E. microphylla* of Cunningham.

*E. dives** and *E. piperita* are two of the Peppermints; the first has small, and often opposite leaves; the latter very large, like a Stringy Bark, but not so thick, nor are they so oblique at the base; flower-buds smaller; lid more hemispherical and sharper at the point, whilst the seed-vessel is more globose; but they vary from Mountain Ash (*E. radiata*) in bark and habit; 5 to 15 feet diameter; 200 feet of clear shaft, etc.

E. melliodora, the Red Flowering or Black Iron Bark; flowers ornamental; delicious honey-like odor, as the name indicates; 60 feet; timber in quality variable.

E. panniculata, and *E. cerebra* (one species), are mere varieties of the White Iron Bark, one of the most valuable trees; specific gravity, 1.016; the breaking weight of a transverse strain of a beam four feet between bearings 1⅞ square, 4,519 lbs.; best of all the Iron Barks; a smooth, uniform outer bark; hard, tough, inlocked strong wood; highly esteemed by coach-makers and wheelwrights for poles, shafts, etc., of carriages, spokes of wheels; also largely for piles and railway sleepers; 150 feet high by 16 feet diameter; both of these are united into one species.

E. siderophloia is the Red or Large-leaved Iron Bark, formerly described as *E. resinifera*; this yields the brown gum or Botany Bay Kino (inspissated juice). The wood though not so tough as the preceding, is considered one of the strongest and most durable of timbers. There are two varieties; both vary from 80 to 120 feet, distinguished by the bark, which is darker color than the *E. panniculata* or White Iron Bark, and the leaves are more uniformly larger.

E. melanophloia is the Silver-leaved or Broad-leaved Iron Bark; a taller tree than the other Iron Barks, and readily known by its stemless or sessile opposite leaves, which are glaucous or mealy white.

E. obliqua, *E. capitella* and *E. macrorhyncha*—Hon. Wm. Woolls, F. L. S. (from whom we collate), considers them all as forms of the Stringy Bark, only varying with climate, soil, elevation or proximity to the sea, etc.; rises to 100

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*It is possible this may be the *Shingle tree* (?) of a previous note.

or 120 feet; some of these woods are reported as excellent for house-carpentry, whilst others were inferior; 300 to 400 feet high; the bark makes packing, printing, and even writing paper; also good for mill and paste-boards; the pulp bleaches readily; forms the main mass of forests of the more barren mountains; the thick bark has also been successfully manufactured into door-mats, cheap fences, palings, shingles and wood-work.

E. amygdalina or Almond-leaved Eucalyptus, or Messmate, is like the Stringy Bark, but the upper branches are smooth; 200 feet high; wood not much valued; a hard tree for the settlers to kill, it is so irregular at the base; wood folded or deeply indented, forming clefts or "pockets" so that they cannot ring, belt or girdle the tree to advantage, for they fail to reach all the bark of these hollows. In the Messmate the leaves are not so thick as in the Stringy Bark, nor are they so oblique at the base; flower-buds are smaller; lid more hemispherical, and its point sharper, whilst the seed-vessel is more globose; but they vary from *E. radiata* in bark and habit; 5 to 15 feet diameter, with 200 feet of clean shaft.

Dr. Mueller's scientific work abounds in varied information; but collations from that work are omitted to avoid repetition. For medical and manifold uses see his work.

P. S.—As Dr. Mueller's "Additions to the List of Principal Timber Trees, etc." (Issued 1871-2, by the Victorian Acclimatization Society) is not accessible to many, we extract the following:

E. botryoides, Smith. From East Gipps Land to South Queensland. One of the most stately among many species, remarkable for its dark green shady foliage. It delights on river banks—80 feet without a branch, diameter of 8 feet. Timber usually sound to the center; water work, wagons, knees of boats, etc., for posts very lasting, as no decay was observed in 14 years.

E. brachypoda, Turc. Widely dispersed over the most arid tropical and extra-tropical inland regions of Australia. One of the best trees for desert tracts; in favorable places 150 feet high. Wood brown, sometimes very dark, hard, heavy and elastic, prettily marked, used for cabinet work, but more particularly for piles, bridges and railway sleepers. (Rev. Dr. Woolls).

E. calophylla, R. Brown. S. W. Australia. More umbrageous than most Eucalypti, and of comparatively rapid growth. The wood is free of resin when grown on alluvial land, but not so when produced on stony ranges. Preferred to *E. marginata* and *E. cornuta* for rafters, spokes and fence-rails—strong and light but not lasting long underground. Bark valuable for tanning, as an admixture to *Acacia* bark.

E. cornuta. S. W. Australia. A large tree of rapid growth, prefers a somewhat humid soil. Used for various artizan work, preferred for strongest shafts and frames of carts, and work requiring hardness, toughness and elasticity.

E. crebra, F. V. Mueller. The narrow-leaved Iron Bark of N. S. Wales and Queensland. Wood reddish, hard, heavy, elastic and durable; for bridges much in use, also for wagons, piles, fencing, etc. *E. melanophoia*, (F. V. M.) the silver-leaved Iron Bark; *E. leptophleba: E. trachyphloia* and *E. drepanphylla* are closely allied species of similiar value. They all exude astringent gum-resin in considerable quantity, like Kino in appearance and property.

E. Doratoxylon, F. V. M. The spearwood of S. W. Australia. In sterile districts. The stem is slender and remarkably straight, wood firm and elastic; nomadic natives wander far to obtain it for their spears.

E. eugenioides, S. N. S. Wales. Regarded by the Rev. Dr. Woolls as a fully distinct species. Its splendid wood, there often called Blue Gum tree wood, available for many purposes, and largely utilized for ship building.

E. goniocalyx, F. V. M. From Cape Otway to the southern parts of N. S. Wales. A large tree, which should be included among those for new plantations. Its wood resembles in many respects that of *E. globulus*, proved a valuable timber for house building, fence rails, etc.

E. Gunnii, J. Hook. At Alpine and sub-Alpine elevations.

The other more hardy Eucalypts comprise *E. coriacea*, *E. E. alpina, urnigera*, *E. coccifera*, and *E. vernicosa*, which all reach heights covered with snow for several months in the year.

E. Leucoxylon, F. V. M. (*E. sideroxylon*, syn.) The common Iron bark of Victoria. Some parts of S. Australia and N. S. Wales. As this durable timber is falling short, and for some purposes superior to almost any other Eucalypt, its culture should be fostered, especially as it can be raised on stony ridges of little use. The wood is pale, sometimes dark. The tree restricted generally to the lower silurian sandstone and slate, with ironstone and quartz. It is rich in Kino.

E. Phœnicea, F. V. M. Little is known of the timber, but the brilliancy of its scarlet flowers should commend it to extensive culture. For the same reason also *E. miniata* from North Australia, and *E. ficifolia* from S. W. Australia. Carpenteria and Arnheim's Land.

E. platyphylla, F. V. M. Queensland. One of the best shade trees. Rev. Mr. Woods saw leaves 1½ long by 1 foot wide. Thrives in open or exposed localities.

E. tesselaris, F. V. M. N. Australia and Queensland. Furnishes a brown, rather elastic wood, not very hard, available for varied artizan work, staves, flooring, etc. Exudes much astringent gum-resin.

Mr. Stearns made some verbal remarks concerning Dr. Kellogg's paper, and mentioned the proper and improper methods of transplanting the young trees.

Mr. Stearns also called the attention of the Academy to the peculiarities of certain young trout in the hatching troughs at Berkeley. Some of the fish which were hatched from eggs brought from the Eastern States by rail, were double—some two heads and one tail, and others were distinctly formed but joined together by a filmy substance.

A letter was read from Prof. D. C. Gilman, President of the University of California, inviting the members of the Academy to hold a session at Berkeley on Monday, February 22d.

The invitation was accepted, and the Academy adjourned to meet at Berkeley on Monday, February 22d, at 11 A. M.

Special Meeting at Berkeley, February 22d, 1875.

Henry G. Hanks in the Chair.

Mr. Stearns, in behalf of the Academy, made some remarks to those present, reminding the members that the Academy must depend mainly upon the University to fill its ranks as time thinned it of its pioneers.

Professor Joseph LeConte read the following paper, the result of original investigations near Lake Tahoe:

On some of the Ancient Glaciers of the Sierra.

BY JOSEPH LE CONTE,

Professor of Geology of the University of California.

II.—Some of the Tributaries of Lake Valley Glacier.

Last summer I had again an opportunity of examining the pathways of some of the ancient glaciers of the Sierra. It will be remembered, by those interested in this subject, that two years ago I published a paper with the above title.* One of the grandest of the glaciers there mentioned was one

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*Am. Journal, Ser. III, Vol. 5, p. 125. Proc. Cal. Acad. Sciences, Vol. IV, part 5, p. 259.

which I called *Lake Valley Glacier*. Taking its rise in snow fountains amongst the high peaks in the neighborhood of Silver Mountain, this great glacier flowed northwards down Lake Valley, and gathering tributaries from the summit ridges on either side of the valley, but especially from the higher western summits, it filled the basin of Lake Tahoe, forming a great mer de glace, 50 miles long, 15 miles wide, and at least 2,000 feet deep, and finally escaped northeastward to the plains. The outlets of this great mer de glace are yet imperfectly known. A part of the ice certainly escaped by Truckee Cañon, (the present outlet of the lake); a part probably went over the northeastern margin of the basin. My studies during the summer were confined to some of the larger tributaries of this great glacier.

Truckee Cañon and Donner Lake Glaciers.—I have said that one of the outlets of the great mer de glace was by the Truckee River Cañon. The stage road to Lake Tahoe runs in this cañon for fifteen miles. In most parts of the cañon the rocks are volcanic and crumbling, and therefore ill adapted to retain glacial marks; yet in some places where the rock is harder these marks are unmistakable. On my way to and from Lake Tahoe, I observed that the Truckee Cañon glacier was joined at the town of Truckee by a short but powerful tributary, which, taking its rise in an immense rocky amphitheater surrounding the head of Donner Lake, flowed eastward. Donner Lake, which occupies the lower portion of this amphitheater, was evidently formed by the down-flowing of the ice from the steep slopes of the upper portion near the *summit*. The stage road from Truckee to the summit runs along the base of a *moraine* close by the margin of the lake on one side, while on the other side, along the apparently almost perpendicular rocky face of the amphitheater, 1,000 feet above the surface of the lake, the Central Pacific Railroad winds its fearful way to the same place. In the upper portion of this amphitheater large patches of snow still remain unmelted during the summer.

My examination of these two glaciers, however, was very cursory. I hasten on, therefore, to others which I traced more carefully.

As already stated in my former paper, Lake Tahoe lies countersunk on the very top of the Sierra. This great range is here divided into two summit ridges, between which lies a trough 50 miles long, 20 miles wide, and 3,000–3,500 feet deep. This trough is Lake Valley. Its lower half is filled with the waters of Lake Tahoe. The area of this lake is about 250 square miles, its depth 1,640 feet, and its altitude 6,200 feet. It is certain that during the fullness of glacial times this trough was a great mer de glace, receiving tributaries from all directions except the north. But as the glacial epoch waned—as the great mer de glace dwindled and melted away, and the lake basin became occupied by water instead, the tributaries still remained as separate glaciers flowing into the lake. The tracks of these lingering smaller glaciers are far more easily traced, and their records far more easily read, than are those of the greater but more ancient glacier of which they were but once the tributaries.

Of the two summit ridges mentioned above, the western is the higher. It bears the most snow *now*, and in glacial times gave origin to the grandest

glaciers. Again: the peaks on both these summits rise higher and higher as we go toward the upper or southern end of the lake. Hence the largest glaciers ran into the lake at its *southwestern* end. And, since the mountain slopes here are towards the northeast and therefore the shadiest and coolest, here also the glaciers have had the greatest vitality and lived the longest, and have, therefore, left the plainest record. Doubtless, careful examination would discover the pathways of glaciers running into the lake from the eastern summits also; but I failed to detect any very clear traces of such, either on the eastern or on the northern portion of the western side of the lake; while between the southwestern end and Sugar Pine Point, a distance of only eight or ten miles, I saw distinctly the pathways of five or six. North of Sugar Pine Point there are also several *They are all marked by moraine ridges running down from the summits and projecting as points into the lake.* The pathways of three of these glaciers I studied somewhat carefully, and after a few preliminary remarks, will describe in some detail.

Mountains are the culminating points of the scenic grandeur and beauty of the earth. They are so, because they are also the culminating points of all geological agencies—igneous agencies in mountain *formation*, aqueous agencies in mountain *sculpture*. Now, I have already said that the mountain peaks which stand above the lake on every side, are highest at the southwestern end, where they rise to the altitude of 3,000 feet above the lake surface, or between 9,000 and 10,000 feet above the sea. Here, therefore, ran in the greatest glaciers, here we find the profoundest glacial sculpturings, and here also are clustered all the finest beauties of this the most beautiful of mountain lakes. I need only name Mt. Tallac, Fallen Leaf Lake, Cascade Lake, and Emerald Bay, all within three or four miles of each other and of the Tallac House. These three exquisite little lakes, (the Emerald Bay is also almost a lake) nestled closely against the loftiest peaks of the western summit ridge, are all perfect examples of glacial lakes.

South of Lake Tahoe, Lake Valley extends for fifteen miles as a plain, gently rising southward. At its lower end it is but a few feet above the lake surface, covered with glacial drift modified by water, and diversified, especially on its western side, by débris ridges, the moraines of glaciers which continued to flow into the valley or into the lake long after the main glacier, of which they were once tributaries, had dried up. On approaching the south end of the lake by steamer, I had observed these long ridges, divined their meaning, and determined on a closer acquaintance. While staying at the Tallac House I repeatedly visited them, and explored the cañons down which their materials were brought. I proceed to describe them.

Fallen Leaf Lake Glacier.—Fallen Leaf Lake (see map) lies on the plain of Lake Valley, about one a half miles from Lake Tahoe, its surface but a few feet above the level of the latter lake, but its bottom far, probably several hundred feet, below that level. It is about three to three and one-half miles long and one and one-fourth miles wide. From its upper end runs a cañon bordered on either side by the highest peaks in this region. The rocky walls of this cañon terminate on the east side at the head of the lake, but on the west side, a little further down. The lake is bordered on each side by an

admirably marked débris ridge (moraines) three hundred feet high, four miles long, and one and one-half to two miles apart. These moraines may be traced back to the termination of the rocky ridges which bound the cañon. On the one side the moraine lies wholly on the plain; on the other side its upper part lies against the slope of Mt. Tallac. Near the lower end of the lake a somewhat obscure branch ridge comes off from each main ridge, and curving around they form an imperfect terminal moraine, through which the outlet of the lake breaks its way.

On ascending the cañon the glaciation is very conspicuous, and becomes more and more splendid at every step. From Soda Springs (map s. s.) upwards, it is the most beautiful I have ever seen. In some places, for many acres in extent, the whole rocky bottom of the cañon is smooth and polished, and gently undulating, like the surface of a glassy but billowy sea. The glaciation is distinct, also, up the sides of the cañon 1,000 feet above its floor.

There can be no doubt, therefore, that a glacier once came down this cañon, filling it 1,000 feet deep, scooped out Fallen Leaf Lake just where it struck the plain and changed its angle of slope, and pushed its snout four miles out on the level plain, nearly to the present shores of Lake Tahoe, dropping its débris on either side, and thus forming a bed for itself. In its subsequent retreat it seems to have rested its snout some time at the lower end of Fallen Leaf Lake, and accumulated there an imperfect terminal moraine. The outlines of this little lake, with its bordering moraines, are shown in the diagram map.

2. *Cascade Lake Glacier.*—Cascade Lake, like Fallen Leaf Lake, is about one and one-half miles from Lake Tahoe, but, unlike Fallen Leaf Lake, its discharge creek has considerable fall, and the lake surface is, therefore, probably 100 feet above the level of the greater lake. On either side of this creek, from the very border of Lake Tahoe, runs a moraine ridge up to the lake, and thence close along each side of the lake up to the rocky points which terminate the true mountain cañon above the head of the lake. I have never anywhere seen more perfectly defined moraines. I climbed over the larger western moraine and found that it is partly merged into the eastern moraine of Emerald Bay to form a medial at least 300 feet high, and of great breadth, (see map.) From the surface of the little lake, the curving branches of the main moraine, meeting below the lake to form a terminal moraine, are very distinct. At the head of the lake there is a perpendicular cliff over which the river precipitates itself, forming a very pretty cascade of 100 feet or more. On ascending the cañon above the head of the lake, for several miles, I found, everywhere, over the lip of the precipice, over the whole floor of the cañon, and up the sides 1,000 feet or more, the most perfect glaciation.

There cannot be, therefore, the slightest doubt that this also is the pathway of a glacier which once ran into Lake Tahoe. After coming down its steep rocky bed, this glacier precipitated itself over the cliff, scooped out the lake at its foot, and then ran on until it bathed its snout in the waters of Lake Tahoe, and probably formed icebergs there. In its subsequent retreat it seems to have dropped more débris in its path, and formed a more perfect terminal moraine than did Fallen Leaf Lake Glacier.

Emerald Bay Glacier.—All that I have said of Fallen Leaf Lake and Cascade Lake, apply, almost word for word, to Emerald Bay. This beautiful bay, almost a lake, has also been formed by a glacier. It also is bounded on either side by moraines, which run down to and even project into Lake Tahoe, and may be traced up to the rocky points which form the mouth of the cañon at the head of the bay. Its eastern moraine, as already stated, is partly merged into the western moraine of Cascade Lake, to form a huge medial moraine. Its western moraine lies partly against a rocky ridge which runs down to Lake Tahoe to form Rubicon Point. At the head of the bay, as at the head of Cascade Lake, there is a cliff about 100 feet high, over which the river precipitates itself and forms a beautiful cascade. Over the lip of this cliff, and in the bed of the cañon above, and up the sides of the cliff-like walls, 1,000 feet or more, the most perfect glaciation is found. The only difference between this glacier and the two preceding is, that it ran more deeply into the main lake and the deposits dropped in its retreat did not rise high enough to cut off its little rock basin from that lake, but exists now only as a *shallow bar* at the mouth of the bay. This bar consists of *true moraine matter,* i. e., intermingled boulders and sand, which may be examined through the exquisitely transparent water almost as perfectly as if no water were present. Some of the boulders are of large size.

All that I have described separately and in detail, and much more, may be taken in at one view from the top of Mt. Tallac. From this peak nearly the whole course of these three glaciers, their fountain amphitheaters, their cañon beds, and their lakes enclosed between their moraine arms, may be seen at once. The view from this peak is certainly one of the finest I have ever seen. Less grand and diversified in mountain forms than many from peaks above the Yosemite, it has the added beauty of extensive water surface, and the added interest of several glacial pathways in a limited space. The observer sits on the very edge of the fountain amphitheaters still holding large masses of snow: immediately below, almost at his feet, lie glistening, gem-like, in dark, rocky setting, the three exquisite little lakes; on either side of these, embracing and protecting them, stretch out the moraine arms, reaching toward and directing the eye to the great lake, which lies, map-like, with all its sinuous outlines perfectly distinct, even to its extreme northern end, twenty-five to thirty miles away. As the eye sweeps again up the cañon-beds, little lakes, glacier-scooped rock basins, filled with ice-cold water, flash in the sunlight on every side. Twelve or fifteen of these may be seen.

From appropriate positions on the surface of Lake Tahoe, also, all the moraine ridges are beautifully seen at once, but the glacial lakes and the cañon-beds, of course, cannot be seen. I have attempted, in the rough sketch accompanying this paper, to express the combined results of observations from many points. The outlines of the great and small lakes are accurate, as these have been taken from reliable maps. Also the general position of the rocky points, and the moraine ridges, are tolerably correct. But, otherwise, the sketch is intended as an illustrative diagram rather than a topographical map. The view is supposed to be taken from an elevated position above the lake surface, looking southward.

There are several questions of a general nature suggested by my examination of these three glacial pathways, which I have thought best to consider separately.

a. Evidences of the existence of the Great Lake Valley Glacier.—In my former paper I have already given some evidence of the former existence of this glacier in the glacial forms detectable in the upper part of this valley. I will now give some additional evidence gathered last summer.

On the south shore of Lake Tahoe, and especially at the northern or lower end of Fallen Leaf Lake, I found many pebbles and some large boulders of a beautifully striped, agate-like slate. The stripes consisted of alternate bands, of black and translucent white, the latter weathering into milk white, or yellowish, or reddish. It was perfectly evident that these fragments were brought down from the cañon above Fallen Leaf Lake. On ascending this cañon I easily found the parent rock of these pebbles and boulders. It is a powerful outcropping ledge of beautifully striped silicious slate, full of fissures and joints, and easily broken into blocks of all sizes, crossing the cañon about a half mile above the lake. This rock is so peculiar and so easily identified that its fragments become an admirable index of the extent of the glacial transportation. I have, myself, traced these pebbles only a little way along the western shores of the great lake, as my observations were principally confined to this part; but I learn from my brother, Professor John Le Conte, and from Mr. John Muir, both of whom have examined the pebbles I brought home, that precisely similar fragments are found in great abundance all along the western shore from Sugar Pine Point northward, and especially on the extreme northwestern shore nearly thirty miles from their source. I have visited the eastern shore of the lake somewhat more extensively than the western, and nowhere did I see similar pebbles. Mr. Muir, who has walked around the lake, tells me that they do not occur on the eastern shore. We have, then, in the distribution of these pebbles, demonstrative evidence of the fact that Fallen Leaf Lake glacier was once a tributary of a much greater glacier which filled Lake Tahoe.

The only other agency to which we could attribute this transportation, is that of shore ice and icebergs, which probably did once exist on Lake Tahoe; but the limitation of the pebbles to the western, and especially the northwestern shores, is in exact accordance with the laws of glacial transportation, but contrary to those of floating ice transportation—for lake ice is carried only by winds, and would, therefore, deposit equally on all shores.

Again: I think I find additional evidence of a Lake Tahoe mer de glace in the contrasted character of the northern and southern shores of this lake.

All the little glacial lakes described above are deep at the upper end and shallow at the lower end. Further: all of them have a sand beach and a sand flat at the upper end, and great boulders thickly scattered in the shallow water, and along the shore at the lower end. These facts are easily explained, if we remember that while the glacial *scooping* was principally at the upper end, the glacial *droopings* were principally at the lower end. And further: that while the *glacial* deposit was principally at the lower end, the *river* deposit, since the glacial epoch, has been wholly at the upper end.

Now the great lake, also, has a similar structure. It also has a beautiful sand and gravel beach all along its upper shore, and a sand flat extending above it; while at its lower, or northern end, thickly strewed in the shallow water, and along the shore line, and some distance above the shore line, are found in great abundance *boulders of enormous size.* May we not conclude that similar effects have been produced by similar causes—that these huge boulders were dropped by the great glacier at its lower end? Similar boulders are also found along the northern portion of the eastern shore, because the principal flow of the ice-current was from the southwest, and in the fullness of glacial times the principal exit was over the northeastern lip of the basin.

b. Origin of Lake Tahoe.—That Lake Tahoe was once wholly occupied by ice, I think, is certain, but that it was scooped out by Lake Valley glacier is perhaps more doubtful. All other Sierra lakes which I have seen certainly owe their origin to glacial agency. Neither do I think we should be staggered by the size or enormous depth of this lake. Yet, from its position, it may be a plication-hollow, or a trough produced by the formation of two parallel mountain ridges, and afterwards modified by glacial agency, instead of a pure glacial-scooped rock-basin. In other words, Lake Valley, with its two summit ridges, *may well be regarded as a phenomena belonging to the order of mountain-formation and not to the order of mountain sculpture.* I believe an examination of the rocks of the two summit ridges would probably settle this. In the absence of more light than I now have, I will not hazard an opinion.

c. Passage of slate into granite.—From the commencement of the rocky cañon at the head of Fallen Leaf Lake, and up for about two miles, the cañon walls and bed are composed of *slate.* The slate, however, becomes more and more metamorphic as we go up, until it passes into what might be called *trap.* In some places it looks like *diorite*, and in others like *porphyry.* I saw no evidence, however, of any outburst. This latter rock passes somewhat more rapidly into *granite* at Soda Springs. From this point the cañon bed and lower walls are granite, but the highest peaks are still a dark, splintery; metamorphic slate. The glacial erosion has here cut through the slate and bitten deep into the underlying granite. The passage from slate through porphyritic diorite into granite, may, I think, be best explained by increasing degree of metamorphism, and at the same time a change of the original sediments at this point, granite being the last term of metamorphism of pure clays, or clayey sandstones, while bedded diorites are similarly formed from ferruginous and calcareous slates. Just at the junction of the harder and tougher granite with the softer and more jointed slates, occur, as might be expected, cascades in the river. It is probable that the cascades at the head of Cascade Lake and Emerald Bay mark, also, the junction of the granite with the slate—only the junction here is covered with débris. Just at the same junction, in Fallen Leaf Lake Cañon, burst out the waters of Soda Springs, highly charged with bicarbonates of iron and soda.

d. Glacial Deltas.—I have stated that the moraines of Cascade Lake and Emerald Bay glaciers run down to the margin of Lake Tahoe. An examination of this portion of the lake shore shows that *they ran far into the lake*—

that the lake has filled in two or three miles by glacial débris. On the east margin of Lake Tahoe, the water, close along the shore, is comparatively shallow, the shore rocky, and along the shore-line, above and below water, are scattered great boulders, probably dropped by the main glacier. But on the west margin of the lake the shore-line is composed wholly of moraine matter, the water very deep close to shore, and the bottom composed of precisely similar moraine matter. In rowing along the shore, I found that the exquisite ultramarine blue of the deep water extends to within 100–150 feet of the shore-line. At this distance, the bottom could barely be seen. Judging from the experiments of my brother, Professor John Le Conte, according to which a white object could be seen at a depth of 115 feet, I suppose the depth along the line of junction of the ultramarine blue and the emerald green water, is at least 100 feet. The slope of the bottom is, therefore, nearly, or quite, 45°. It seems, in fact, a direct continuation beneath the water of the moraine slope. The materials, also, which may be examined with ease through the wonderfully transparent water, are exactly the same as that composing the moraine, viz: earth, pebbles, and boulders of all sizes, some of them of enormous dimensions. It seems almost certain that *the margin of the great Lake Valley glacier, and of the lake itself when this glacier had melted and the tributaries first began to run into the lake, was the series of rocky points at the head of the three little lakes, about three or four miles back from the present margin of the main lake; and that all lakeward from these points has been filled in and made land by the action of the three glaciers described.* At that time Rubicon Point was a rocky promontory, projecting far into the lake, beyond which was another wide bay, which has been similarly filled in by débris brought down by glaciers north of this point. The long moraines of these glaciers are plainly visible from the lake surface; but I have not examined them. Thus, all the land, for three or four miles back from the lake-margin, both north and south of Rubicon Point, is composed of *confluent glacial deltas*, and on these deltas the moraine ridges are the *natural levées* of these ice-streams

e. Parallel Moraines.—The moraines described above are peculiar and almost unique. Nowhere, except about Lake Tahoe and near Lake Mono, have I seen moraines in the form of *parallel ridges*, lying on a level plain and terminating abruptly *without any signs of transverse connection* (*terminal moraine*) *at the lower end*. Nor have I been able to find any description of similar moraines in other countries. They are not terminal moraines, for the glacial pathway is open below. They are not lateral moraines, for these are borne on the glacier itself, or else stranded on the steep cañon sides. Neither do I think moraines of this kind would be formed by a glacier emerging from a steep narrow cañon and running out on a level plain; for in such cases, as soon as the confinement of the bounding walls is removed, the ice stream spreads out into an *ice lake*. It does so as naturally and necessarily as does water under similar circumstances. The deposit would be nearly transverse to the direction of motion, and, therefore, more or less crescentic. There must be something peculiar in the conditions under which these parallel ridges were formed. I believe the conditions were as described below.

We have already given reason to think that the original margin of the lake in glacial times was three or four miles back from the present margin, along the series of rocky points against which the ridges abut; and that all the flat plain thence to the present margin is made land. If so, then it is evident that at that time the three glaciers described ran far out into the lake, until reaching deep water, they formed icebergs. Under these conditions, it is plain that the pressure on this, the subaqueous portion of the glacial bed, would be small, and become less and less until it becomes nothing at the point where the icebergs float away. The pressure on the bed being small, not enough to overcome the cohesion of the ice, there would be no spreading. *A glacier running down a steep narrow cañon and out into deep water, and forming icebergs at its point, would maintain its slender, tongue-like form, and drop its débris on each side, forming parallel ridges, and would not form a terminal moraine, because the materials not dropped previously would be carried off by icebergs.* In the subsequent retreat of such a glacier, imperfect terminal moraines might be formed higher up, where the water is not deep enough to form icebergs. It is probable, too, that since the melting of the great mer de glace and the formation of the lake, the level of the water has gone down considerably, by the deepening of the Truckee Cañon outlet by means of erosion. Thus, not only did the glaciers retreat from the lake, but also the lake from the glaciers.

As already stated, similar parallel moraine ridges are formed by the glaciers which ran down the steep eastern slope of the Sierras, and out on the level plains of Mono. By far the most remarkable are those formed by Bloody Cañon Glacier, and described in my former paper. These moraines are six or seven miles long, 300–400 feet high, and the parallel crests not more than a mile asunder. There, also, as at Lake Tahoe, we find them terminating abruptly in the plain without any sign of terminal moraine. But higher up there are small, imperfect, transverse moraines, made during the subsequent retreat, behind which water has collected, forming lakes and marshes. But observe: these moraines are also *in the vicinity of a great lake*; and we have abundant evidence, in very distinct terraces described by Whitney,* and observed by myself, that in glacial times the *water stood at least six hundred feet above the present level.* In fact, there can be no doubt that at that time the waters of Mono Lake (or a much greater body of water of which Mono is the remnant) washed against the bold rocky points from which the débris ridges start. *The glaciers in this vicinity, therefore, must have* run out into the water six or seven miles, and doubtless formed icebergs at their point, and, therefore, formed no terminal moraine there.

That the glaciers described about Lake Tahoe and Lake Mono ran out far into water and formed icebergs, I think is quite certain, and that parallel moraines opened below are characteristic signs of such conditions, I also think nearly certain.

f. Glacial Erosion.—My observation on glacial pathways in the high Sierra, and especially about Lake Tahoe, have greatly modified my views as to the

* Geological Survey of California, Vol. I, p. 451.

nature of glacial erosion. All writers on this subject seem to regard glacial erosion as mostly, if not wholly, a *grinding* and *scoring;* the débris of this erosion as rock-meal; the great boulders which are found in such immense quantities in the terminal deposit, as derived wholly from the crumbling cliffs above the glacial surface; the *rounded* boulders, which are often the most numerous, as derived in precisely the same way, only they have been engulfed by crevasses, or between the sides of the glacier and the bounding wall, and thus carried between the moving ice and its rocky bed, as between the upper and nether millstone. In a word, all boulders, whether angular, or rounded, are supposed to owe their *origin* or *separation* from their parent rock to atmospheric agency, and only their *transportation* and *shaping* to glacial agency.

Now, if such be the true view of glacial erosion, evidently its effect in mountain sculpture must be small indeed. Roches moutonneés are recognized by all as the most universal and characteristic sign of a glacial bed. Sometimes these beds are only imperfectly moutonneés, i. e., they are composed of *broken angular surface with only the points and edges planed off.* Now, moutonneés surfaces always, and especially angular surfaces with only points and edges beveled, show that the erosion by grinding has been only very superficial. They show that if the usual view of glacial erosion be correct, the great cañons, so far from being *formed*, were only very *slightly modified* by glacial agency. But I am quite satisfied from my own observations that this is not the only *nor the principal* mode of glacial erosion. I am convinced that a glacier, by its enormous pressure and resistless onward movement, is *constantly breaking off large blocks* from its bed and bounding walls. Its erosion is not only a grinding and scoring, but also a *crushing and breaking.* It makes by its erosion not only rock-meal, but also large *rock-chips.* Thus, a glacier is constantly breaking off blocks and making angular surfaces, and then grinding off the angles both of the fragments and the bed, and thus forming rounded boulders and moutonneés surfaces. Its erosion is a constant process of alternate *rough hewing* and *planing.* If the rock be full of fissures, and the glacier deep and heavy, the rough hewing so predominates that the plane has only time to touch the corners a little before the rock is again broken and new angles formed. This is the case high up on the *cañon walls*, at the head of Cascade Lake and Emerald Bay, but also in the *cañon beds wherever the slate is approached.* If, on the other hand, the rock is very hard and solid, and the glacier be not very deep and heavy, the planing will predominate over the rough hewing, and a smooth, gently billowy surface is the result. This is the case in the hard granite forming the beds of all the cañons high up, but especially high up the cañon of Fallen Leaf Lake, where the cañon spreads out, and extensive but comparatively thin snow-sheets have been at work. In some cases *on the cliffs*, subsequent disintegration of a glacier-polished surface may have given the appearance of angular surfaces with beveled corners; but, in other cases, in the *bed of the cañon*, and on elevated level places, where large loosened blocks could not be removed by water nor by gravity, I observed the same appearances, under conditions which forbid this explanation. Mr. Muir, also, in his Studies in the Sierra, gives many examples of undoubted rock-breaking by ancient glaciers.

Angular blocks are, therefore, mostly the ruins of crumbling cliffs, borne on the surface of the glacier and deposited at its foot. Many *rounded* boulders also have a similar origin, having found their way to the bed of the glacier through crevasses, or along the sides of the glacier. But *most of the rounded boulders* in the terminal deposit of *great glaciers* are fragments *torn off by the glacier itself.* The proportion of angular to rounded boulders—of upper or air-formed to nether or glacier-formed fragments, depends on the depth and extent of the ice current In the case of the universal ice-sheet (ice-flood) there is, of course, no upper formed or angular blocks at all—there is nothing borne on the surface. The moraine, therefore, consists wholly of nether-formed and nether-borne severely triturated materials (*moraine profonde*). The boulders are, of course, all rounded. This is one extreme. In the case of the thin moving ice-fields—the *glacierets* still lingering amongst the highest peaks and shadiest hollows of the Sierra—on the other hand, the moraines are composed *wholly of angular blocks.* This is the character of the terminal moraine of Mt. Lyell glacier, described in my previous paper. These glacierets are too thin and feeble and torpid to break off fragments—they can only *bear* away what falls on them. This is the other extreme. But in the case of ordinary glaciers—*ice streams*—the boulders of the terminal deposit are mixed; the angular or upper-formed predominating in the small existing glaciers of temperate climates, but the rounded, or nether-formed, greatly predominating in the grand old glaciers of which we have been speaking. In the terminal deposits of these, especially in the materials pushed into the lake, it is somewhat difficult to find a boulder which has not been subjected to severe attrition.

Professor John LeConte described two new pieces of apparatus lately added to that of the University, one for projecting microscopic objects, and the other for measuring the force of electric currents.

Dr. Kellogg read a paper on Hops.

Resolutions expressive of interest in the affairs of the University, and satisfaction at the advancment made, were adopted.

President Gilman then addressed the members, after which the Academy adjourned to examine the buildings and grounds.

Regular Meeting, March 1st, 1875.

Robert E. C. Stearns in the Chair.

Eighteen members present.

The following names were submitted as candidates for membership: Alfred E. Regensberger, Jas. B. Clifford and Charles Frances.

Donations to the Museum: From Professor Davidson, specimen of Mandarin Duck from Nagasaki, Japan. From Mrs. John Torrence, specimens of *Ostrea titan* from San Luis Obispo Co. From Captain S. P. Griffin of the Steamship "City of Peking," specimens of eyeless eels (genus *Petromyzen* or *Bellostoma?*), caught coiled around fishing line in seven fathoms of water, mud bottom, in Fortesque Bay, Straits of Magellan, November 25, 1874; also intestinal worms found in the porpoise. Jas. Dean presented three Indian pestles made of stone, and nine bone bodkins or pins, from a large mound, covering two acres, and twenty-five feet deep, at Visitacion Valley, near San Bruno road; also specimens of coals from Queen Charlotte's Island; also coal from Vancouver's Island, and specimen of bog iron. E. O. McDevitt donated a large and choice assortment of New Zealand minerals. From Mrs. J. J Greene, fossil, *Tamiosona gigantea*, from Wild Horse Cañon, eight miles from Lowe's station.

The Secretary read a paper by S. B. Christy, as follows:

Notes on a Meteor seen at Berkeley.

BY S. B. CHRISTY.

On the evening of December 9, 1874, as I was sitting in my room, I happened to have my attention called to something without, and while looking from my window saw, what at first appeared to be the moon in her first quarter, of about the *same size*, *color* and *brilliancy*, shining through a dim fog, which latter was heavy enough to obscure all the lesser stars. As, however,

it flashed over me in a second that the moon was not out at that time a
place, and as above all it was moving steadily downwards, and to the left
watched it with attention and noticed that it seemed to grow a little larger a
brighter, until finally, like a piece of burning paper, it seemed to flare
suddenly with a *reddish* light, and go out in silence.

The next day but one, as Professor John LeConte had asked me to reco
its appearance, as near as may be, I repaired to the same place at about t
same time as before, so as to have the conditions as near the same as befo
and with a transit took the bearings of its course as nearly as could be do
by such a rude means of approximation.

Bearing at commencement.......................................S. 83°
Bearing at end...S. 81°
Altitude at commencement..
Altitude at end...

The duration, as near as I could judge, was one second. The date, Decem
ber 9, 1874; 6:30 P. M.

Charles Wolcott Brooks read the following:

Report of Japanese Vessels wrecked in the North Pacific Ocean, from the Earliest Records to the Present Time.

BY CHARLES WOLCOTT BROOKS.

Every junk found adrift or stranded on the coast of North America, or on the Hawaiian or adjacent islands, has on examination proved to be Japanese, and no single instance of any Chinese vessel has ever been reported, nor is any believed to have existed.

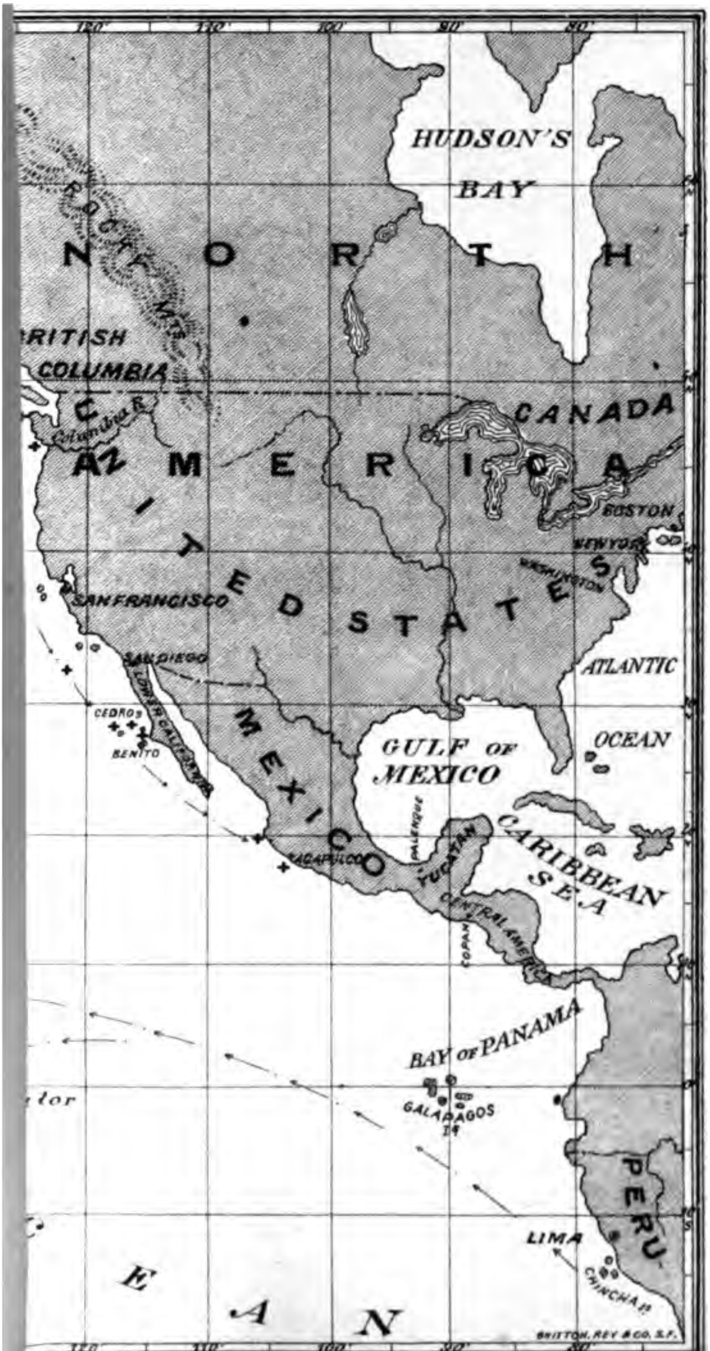
This may be explained by the existence of the Kuro Shiwo, literally "black stream," a gulf stream of warm water, which sweeps northeasterly past Japan toward the Kurile and Aleutian Islands, thence curving around and passing south along the coast of Alaska, Oregon and California. This stream, it is found, has swept these junks toward America at an average rate of fully ten miles a day.

There also exists an ocean stream of cold water, emerging from the Arctic Ocean, which sets south close in along the eastern coast of Asia. This fully accounts for the absence of Chinese junks on the Pacific, as vessels disabled off their coast would naturally drift southward.

A noticeable feature is the large number of disasters on the coast of Japan in the month of January, during which season the strong northeast monsoons blow the wrecks directly off shore into the Kuro Shiwo.

The climate of Japan is temperate, with the exception of the extreme northern provinces, where intense cold prevails and where snow is abundant; and the extreme southern provinces, whose climate is very warm.

About the year 1639 the Japanese Government ordered all junks to be built with open sterns, and large square rudders, unfit for ocean navigation, hoping



DRAWN BY CHARLES WOLCOTT BROOKS.

CAN,

thereby to keep their people isolated within their own islands. Once forced from the coast by stress of weather, these rudders are soon washed away, when the vessels naturally fall off into the trough of the sea, and roll their masts out. The number, of which no record exists, which have thus suffered during the past nineteen centuries must be very large, probably many thousand vessels.

Among Japanese mariners, the fear of being thus blown off their coast, has been an ever-threatening danger; and the memory of such time-honored accidents, is a common feature in the traditions of every seaport settlement along the eastern coast of Japan.

By the Government Census, taken in 1874, the total population of Japan was 33,300,675 souls, and there were 22,670 registered sailing vessels of Japanese style, (junks) of from 8 to 383 tons, engaged in the coasting trade. The crews of ordinary trading junks average from eight to twelve men each.

In the sixteenth year of the reign of the Emperor Suizin, B. C. 81, merchant ships and ships of war are first spoken of as built in Japan.

Under the Shogoon Iyémitsu, about 1639, edicts commanded the destruction of all boats built upon any foreign model, and forbade the building of vessels of any size or shape superior to that of the present junk.

By the imperial decree of 1637, Japanese who had left their country and been abroad, were not allowed to return, death being the penalty for traveling abroad, studying foreign languages, introducing foreign customs, or believing in Christianity.

The Empire of Japan is situated in the northwestern part of the Pacific Ocean, and is composed of four large islands and of a great number of smaller ones. It faces to the northwest the Kingdom of Corea, and is separated from it by the Japan sea. To the northeast the archipelago of Chijima (Kurile Islands) extends towards Kamschatka. At the southwest the Liu Kiu Islands are situated opposite the Island of Formosa.

Its whole length, extending from one end to the other of the empire, measures more than 500 Ris (about 1225 English miles), and its breadth varies from 20 to 60 Ris (about 73½ to 146 English miles.) Its total area is 23,740 Square Ris.

The sources of information at command have been exceptionally good. During seventeen years, in which I represented the Government of Japan at this port, it has been my pleasure to devote much critical attention to the subject of Japanese wrecks, picked up adrift in the North Pacific Ocean and stranded upon the northwest coast of America and its various outlying islands, and those of the chain extending from Hawaii towards Niphon. Besides keeping a detailed record of all wrecks reported during this period, I have also collected and verified many cases of earlier reports, which although still extant, were likely to be overlooked.

In at least 37 of the cases quoted, I have either seen the saved, or received a personal account from those who were themselves witnesses. Hawaiian and Japanese traditions I have myself gathered in those countries.

In March, 1860, I took an Indian boy on board the Japanese steam corvette *Kanrin-maru*, where a comparison of Coast-Indian and pure Japanese words was made at my request, by Fukuzawa Ukitchy, then Admiral's Secretary;

the result of which I prepared for the press, and it was at that time published in the *Evening Bulletin*, suggesting further linguistic investigation.

The following examples submitted for consideration to the Academy, fairly illustrate the subject in its various phases:—

1. In Mr. Hubert H. Bancroft's unparalleled collection of ancient books and valuable manuscripts relating to the early history of the native races of the Pacific States, mention is made of several Japanese vessels reported in some of the Spanish-American ports on the Pacific. In 1617 a Japanese junk belonging to Magomé, was at Acapulco.

In 1613, June 10th, the British ship *Clove*, Capt. John Saris, arrived at Nagasaki, having on board one Japanese, picked up from the island of Bantam.

2. "In 1685," we read, "the Portuguese tried for the last time to re-establish their trade by sending back a number of shipwrecked Japanese, picked up adrift, to their own country. The Japanese did not molest them, but strictly prohibited their re-appearance on the Coast of Japan."

3. In 1694, a Japanese junk from Osaka was driven by adverse winds and weather and stranded on the coast of Kamschatka, at the mouth of the river Opala, on the south of Bolschaia Reka. The only survivor was afterwards taken to Moscow.

Muller, in his "Voyages from Asia to America," published in 1761, remarks that when in 1696 the Russians reported the above, they said: "we have learned of several other instances of Japanese wrecks previously stranded on the coast of Kamschatka."

4. In 1710, a Japanese junk was stranded on the coast of Kamschatka, in Kaligirian bay, north of Awatscha. Ten persons landed safely, of which four were killed and six taken captive in an encounter with Kamschadels. Subsequently four of the captives fell into Russian hands, and one named Sanima, was sent in 1714 to St. Petersburg.

5. On the 8th of July, 1729, a Japanese junk called the *Waka-shima* of Satsuma, in distress, after having been driven about at sea for six months, was finally stranded on the coast of Kamschatka, south of Awatscha bay, and 17 of her crew were saved. She was loaded with cotton and silk stuffs, rice and paper; the two latter articles shipped by *Matsudaira Osumi-no-kami*, (Prince of Satsuma) were government property.

A petty Russian officer named Schtinnikow, desiring to plunder the cargo, had fifteen of the survivors shot; for which crime he was subsequently condemned and hung. The two remaining, an old merchant named Sosa and a young pilot Gonsa, were sent to Irkutz in 1721, and thence via Tobolsk, they reached St. Petersburg in 1732, where one died in 1736, the other in 1739.

6. In 1782 a Japanese junk was wrecked upon the Aleutian Islands, from which the survivors were taken in one of the Russian-American Company's vessels to the town of Ochotsk, and thence to the inland city of Irkutsk. In 1792, the Governor-General of Siberia ordered the transport *Catherine*, then at Ochotsk, to return these men to their native country. The Russian vessel, after wintering in a harbor at the north end of Yeso, proceeded to the port of Hakodaté, where the Japanese officials politely but

firmly refused to allow their countrymen to land. They were subsequently returned to Siberia.

7. Among items of history mentioned in Japanese records, I find that in October, 1804, a Russian frigate commanded by Capt. Krusenstern, conveying Count Resanoff, as Ambassador of the Czar, brought back to Nagasaki five Japanese seamen, being part of a crew of fifteen rescued from a stranded junk; the other ten preferred to remain in Siberia.

8. In 1805, a Japanese junk was wrecked on the coast of Alaska, near Sitka; the seamen were quartered on Japonski Island, whence they were taken by the Russians, and finally landed on the Coast of Yeso in 1806.

9. In 1812, Capt. Ricord, commanding the Russian sloop-of-war *Diana*, took seven Japanese, six of whom were seamen recently shipwrecked in a junk on the coast of Kamschatka, in the hope of exchanging them for seven captive Russians, confined in Japan. Being unable to land, they were returned to Kamschatka, reaching there October 12th. The *Diana* made a second attempt, and finally succeeded August 16th, 1813, in landing these Japanese at Kunashie Bay, the 20th Kurile, and effected the liberty of the Russian Capt. Golownin and his associates.

10. In 1813, the Brig *Forrester*, Captain John Jennings, when in latitude 49° N., longitude 128° W., rescued the captain and two seaman from a dismasted junk, timber laden, when 18 months from Yeso, bound to Niphon. Thirty-five men were on board, of whom thirty-two died of hunger. They were delivered to the Russians, who undertook to return them to Japan.

11. Captain Alexander Adams, formerly pilot at Honolulu, relates that March 24, 1815, in latitude 32° 45′ N., longitude 126° 57′ W., when sailing master of brig *Forrester*, Captain Piggott, and cruising off Santa Barbara, California, he sighted at sunrise a Japanese junk drifting at the mercy of the winds and waves. Her rudder and masts were gone. Although blowing a gale, he boarded the junk, and found fourteen dead bodies in the hold, the captain, carpenter, and one seaman alone surviving; took them on board, where by careful nursing they were well in a few days. They were on a voyage from Osaka to Yedo, and were 17 months out, having been dismasted in consequence of losing their rudder.

12. In 1820, a junk was cast upon Point Adams, the southern shore of the mouth of Columbia river. The vessel, which was laden with wax, went to pieces, and the crew, many in number, landed safely.

13. A junk was wrecked on Queen Charlotte's Island, in 1831.

14. December 23, 1832, at mid-day, a junk in distress cast anchor near the harbor of Waialua, on the shores of Oahu. She was from a southern port of Japan, bound to Yedo with a cargo of fish; lost her rudder and was dismasted in a gale, since which she had drifted for eleven months. Five out of her crew of nine had died. December 30th, she started for Honolulu, but was stranded on a reef off Barber's Point on the evening of January 1, 1833.

The four survivors were taken to Honolulu, where, after remaining eighteen months, they were forwarded to Kamschatka, whence they hoped to work their way south through the northern islands of the group into their own country. This junk was about 80 tons burden. According to the tra-

ditions of the islands, several such junks had been wrecked upon Hawaii, before the islands were discovered by Captain Cook.

15, 16. In 1833, a Japanese junk was wrecked on the coast of Washington Territory, in the immediate vicinity of Cape Flattery. Many of her crew had perished, and several dead bodies were found headed up in firkins, in customary Japanese style, ready for burial. Out of 17 persons, the only survivors, two men and a boy, were rescued from the Indians, by the Hudson Bay Company's vessel *Lama*, Captain McNeal, who took them to England, touching at Honolulu on their way. Thence they proceeded to Canton, where they arrived in 1836, and stopped with Karl Gutzlaff, who learned their language, and intended accompanying them to Japan. In 1837, they left Macao in the American brig *Morrison*, dispatched by Clarence A. King for Yedo bay, to bear them home. Being fired upon, July 27, and prevented from landing, she sailed for Kagosima, where, being equally unsuccessful, she finally returned with the men to Macao. The *Morrison*, on whom Samuel W. Williams and Dr. Peter Parker were passengers, also had on board four other Japanese seamen, rescued from a disabled Japanese junk, which had drifted a long time at sea, until finally stranded on the eastern shore of the Philippine Islands, whence the survivors were forwarded to Macao, to be returned to Japan.

17. In 1839, a wrecked junk was boarded by Captain Cathcart of the American whale ship *James Loper*, drifting in latitude 30° N., longitude 174° W., or about half way between Japan and the Hawaiian Islands.

18. In the *Polynesian*, October 17, 1840, published at Honolulu, I find: "The Japanese who took passage in the *Harlequin* remained at Kamschatka under the protection of the Governor awaiting an opportunity of returning to their native country."

NOTE.—In 1834, the brig *Harlequin* conveyed to Petropaulski from Honolulu 18 Japanese taken from wrecks, who had remained 18 months at Honolulu. They were finally returned to Japan by Russian officials.

In 1840, Mr. Nathaniel Savory, a native of Massachusetts, residing at Port Lloyd, Bonin Islands, reports a Japanese junk of about 40 tons, laden with dried fish, entered that harbor in distress, having been driven from her course along the coast of Japan through stress of weather, with her provisions exhausted. They repaired the damage to the junk during that winter, and she sailed in the spring for Japan. Had these islands been uninhabited, this case would have added another to the list of wrecks.

19. In 1841, a fishing junk from the southeast part of Niphon was wrecked on an uninhabited island, where the three survivors remained six months, until taken off by Captain Whitfield, master of the American whale ship *John Howland*, and brought to Honolulu, where Denzo and Goémon remained, while Nakahama Manjiro went to the United States, and was educated by Captain Whitfield. After being there several years he returned to Honolulu where he found his former companions, and embarked January, 1851, on the *Sarah Boyd*, Captain Whitmore, bound for Shanghai, taking with them a whale-boat called the *Adventure*, with a full rig and outfit. When off the Grand Liu-Kiu, the three Japanese effected a landing and the ship proceeded without stopping. Hence they finally reached Kiushiu and Nagasaki, in the

junk which bears the annual tribute money from Liu-Kiu to Japan. Manjiro afterwards translated Bowditch's Navigator into Japanese, and visited San Francisco as sailing-master of the Japanese steam corvette *Kanrin-maru*, which arrived there March 17th, 1860.

20. In 1845, the United States Frigate *St. Louis* took from Mexico to Ningpo, in China, three shipwreck Japanese, being survivors of the crew of a junk which had drifted from the coast of Japan, entirely across the Pacific Ocean, and finally stranded on the coast of Mexico, where they remained two years. The Chinese authorities were willing to receive these men and return them to their native country by their annual junk, which sails from Cheefoo to Nagasaki; but the Japanese objected to their landing, owing to the law of 1637.

In 1845, the Japanese authorities informed Sir Edward Belcher, commanding H.B.S. *Samarang*, that they would not receive returned Japanese from abroad, but "had sent a junk-full back to the Emperor of China," to whose country they had gone to obtain return passages by the annual junk permitted from Cheefoo to Nagasaki. The above leads to the inference that the *Samarang* may have had shipwrecked Japanese seamen on board.

21. In 1845, April 1st, Captain Mercator Cooper, of Sag Harbor, when in the American whale ship *Manhattan*, rescued eleven shipwrecked Japanese mariners from St. Peters, a small island lying a few degrees southeast of Niphon, and took them to Yedo Bay, where they were received under exception. Captain Cooper is also reported to have fallen in with a sinking junk, from which he rescued as many more Japanese seamen. [See Dr. C. F. Winslow's account in *Friend* of February 2d, 1846.]

22. In 1847, a French whaleship while cruising off Stapleton Island, sighted a fire-signal on the shore, and sent a boat to the relief of five Japanese sailors, who were in a helpless plight; the only survivors of a crew, whose disabled junk lay stranded on the beach of a small bay. Later, about 1853, a party of officers from the U. S. steam frigate *Susquehanna* landed and surveyed this wreck, which they then described as "still partly kept together by large nails of copper, and portions of sheets of metal. Her planks, fastened together at the edge, were but little rubbed or decayed."

23. In 1847, April 21st, the Bremen ship *Otaheite*, Captain Weitung, when in lat. 35° N., long. 156° E., fell in with a Japanese junk in distress, which had lost her rudder and had been driven off the coast of Japan in a gale November, 1846, and had drifted five months. Took off the crew, consisting of nine men, also six tons of wax. She was about 80 tons burden and chiefly laden with paper belonging to Osaka, and bound north. Captain Weitung kept them on board four weeks, and May 19th, 1847, put them on board a junk in the Straits of Matsmai. [See *Polynesian*, October 17, 1847, and *Friend*, December 2, 1847.]

24. In 1848, Captain Cox of New London, Conn., picked up fifteen of twenty Japanese seamen from a disabled junk in lat. 40° N., long. 170° W., and kept them on board six mouths during a cruise in the Ochotsk sea, and finally landed them at Lahaina, where they remained six or eight months.

25. In 1850, during the autumn, S. Senthuro, Toro and J. Heco—the latter then aged 13 years—left Osaka in a junk for Yedo. After discharging and reloading they started to return via Woragawa. After leaving the latter

place their rudder was disabled and they lost their mast and drifted out to sea. Fifty days later the wreck was fallen in with by the American bark *Auckland*, Captain Jennings, who took off and brought the crew of 17 persons to San Francisco, in February, 1851. They were quartered on board the U. S. revenue cutter, and cared for by order of the Collector of the Port. Our citizens generally took much interest in them. The Japanese were subsequently embarked on the U. S. sloop *St. Mary's* and conveyed to Hongkong, where 15 were transferred to the U. S. steamer *Susquehanna* to await the arrival of Commodore Perry and his expedition. Heco and the second mate, Toro, returned to San Francisco on the bark *Sarah Hooper*, reaching there in the autumn of 1852. Sentharo returned with Rev. Mr. Goble, from San Francisco to Japan, and also Toro returned in the American bark *Melita* to Hakodaté from San Francisco, via Honolulu, April 19, 1859.

Toro was for a while clerk with Wells, Fargo & Co., and Joseph Heco, clerk with Macondray & Co. Heco was subsequently appointed for duty on the United States Surveying Schooner *Fennimore Cooper*, about 1858-59, and left her at Honolulu, on account of sickness, but finally returned to Yedo, on the United States steamer *Mississippi*. [See *Evening Bulletin*, June, 1862.]

26. In 1850, April 22d, in lat. 45° N. long. 155° E., the American whale ship *Henry Kneeland*, Clark, master, fell in with a Japanese junk having 13 persons on board. The vessel left Yedo for Kuno, but lost her rudder and was dismasted; then drifted to sea, and had been at the mercy of the winds and currents for sixty-six days, during forty of which they had subsisted on fish and snow water. The Captain and two seamen came to Honolulu on the *H. K.;* two of the crew were transferred to the *Marengo;* six were taken to Petropaulski and taken charge of by the Russian authorities, and two came to Honolulu by the *Nimrod*. [See *Friend*, October 15, 1850; also *Friend*, November 1, 1850.]

NOTE.—In 1851, by Japanese records I find that five Japanese seamen from Honolulu via China arrived at Nagasaki—probably the above.

27. In 1851, a Japanese junk was cast away upon Atka Island, and only three of the crew survived.

28. In 1852, April 15th, in lat. 31° N., long. 150° E., about 300 miles N. N. E. of Guam, Captain West, in the American whaleship *Isaac Howland*, fell in with a small Japanese junk in ballast. The four men on board had but a little oil to sustain life, and were much emaciated. Their tiller was lashed, and the vessel having been forty-nine days out of their reckoning, the crew had given themselves up to die. Two of these men Captain West took to the Atlantic States, and two were transferred to an American whaler about to cruise in the vicinity of the Japanese Islands.

29. In March, 1853, the American ship *John Gilpin*, Captain Doane, passed a water-logged wreck of a junk, her deck awash with the water, in lat. 18° —′ N., long. 145° —′ E., just beyond Pagan and Grigan Islands. Large numbers of fish were around the wreck. There were no survivors on board. She had every appearance of having been a very long time in the water.

30. In 1853, Captain C. M. Scammon discovered the wreck of a Japanese junk, on the southwest or largest of the San Bonito group of Islands, off

Lower California, in lat. 28° N., long. 116° W., and near Cedros Island. [See *Alta*, April 22, 1860.]

Her planks were fastened together on the edges with spikes or bolts of a flat shape, with all of the head on one side. The seams were not quite straight, although the workmanship otherwise was good. That portion of the wreck in sight, was principally the bottom of the vessel, and gave evidence of having been a long time on shore. [Extract from Captain Scammon's log.]

31. In 1854, August 14th, just after Commodore Perry's departure, the American ship *Lady Pierce*, Captain Burrows, arrived at Simoda from San Francisco via Honolulu June 2, 1854. She returned Diyonoské to Japan, who was the sole survivor of a crew of fifteen men, and was picked off from a drifting junk near the Hawaiian Islands, after being seven months helpless at sea. He had resided some time in San Francisco.

32. In 1855, Captain Brooks, in American brig *Leverett*, which arrived here from Ayan, Siberia, November 29th, picked up an abandoned junk in lat. 42° N., long. 170° W., about 900 miles from the American Coast.

33. In 1856, the American bark *Messenger Bird*, Captain Homer, reported a disabled junk at Guam, Ladrone Islands.

34. In 1856, Captain Jno. C. Lawton, in the brig *Prince de Joinville*, while getting guano at Cedros and adjacent islands, reported a Japanese wreck, seen near Magdalena Bay.

35. In 1858, the U.S. surveying schooner *Fennimore Cooper*, Lieut. John M. Brooke, U.S.N. commanding, sailed from Honolulu for a cruise along the chain of islands extending thence towards Japan. He had on board a Japanese seaman named Marsa-Kitchi, whom he landed at Kanagawa. The junk from which this man was taken, was disabled at sea while engaged in the coasting trade, and her crew were forced to put her before the wind, heading to the eastward, a direction in which they were forced against their will. To prevent drifting too rapidly, they lowered their anchor in the open sea to act as a drag, paying out their full length of cable, and thus allowed it to remain until it finally parted.

36. In 1858, May 19th, the British ship *Caribean*, when in lat. 43° 40′ N., long. 171° E., about 1,600 miles from the coast of Japan, fell in with a dismasted junk, which had carried away her rudder, and had been about five months floating helplessly at sea. The captain, mate and ten seamen were rescued and brought to San Francisco, where they arrived June 7, 1858. They were cared for by Captain Winchester, who took them in the *Caribean* to Vancouver Island, whence he was bound for China, but having met a British war vessel off Japan, the rescued men were transferred to her, and thus landed at a Japanese port.

The junk was loaded with barley and rice, and barnacles two feet long were reported found upon the wreck.

The British Government presented £400 to Captain Winchester as a reward and in reimbursement of his necessary outlays.

37. In 1859, the bark *Gambia*, Captain Brooks, found the remains of a Japanese junk on Ocean Island, lat. 28° 24′ N., long. 178° 21′ W.

38, 39. In 1859, July 4th, the remains of two stranded junks, with lower

masts high on the beach, were found on the east or lagoon side of Brooks Island, lat. 28° 11′ N. long. 177° 18′ to 25′ W.

40. May 11th, 1862, the bark *Yankee*, Captain Claxton, passed in lat. 25° 39′ N., long. 138° 24′ W., a wreck with the stump of one mast only standing, of which the wood was quite black with age. The junk was water-logged, and the sea washing entirely over her. Being satisfied there was no life upon her, and a heavy sea running, did not board; passed her three-quarters of a mile to windward, and the *Yankee* kept on her course.

41. In 1862, a Japanese junk was stranded in September near Attu. They had drifted in distress for 90 days, and out of a crew of twelve only three survived. These were taken in 1863 to Nicolaefsky, Amoor river, and then returned to Hakodaté by a Russian war vessel.

42. In 1862, May 4th, the ship *Victor*, Captain Crowell, arrived at San Francisco, with the captain, officers and crew, eleven in number, of the Japanese junk *Io-maru*, from Kanagawa, December 21, 1861, for Owari and Hiogo. On January 5, 1862, was disabled and drifted from land. Was about three months at the mercy of winds and currents, until picked up April 13th, 1862, in lat. 33° N., long. 161° 26′ E., by the *Victor*. They were cared for by Mr. Brooks, Japanese Consul, and by him returned to Japan, in the American schooner *Caroline E. Foote*, for Hakodaté.

43. A Japanese junk drifted past Baker's Island, lat. 0° 13′ N., long. 176° 22′ W., some time in 1863. Boats were sent out and towed it on to the beach. There were four Japanese bodies on board; all were dead.

44. In 1864, February 4th, on Providence Island, lat. 9° 52′ N., long. 160° 65′ E., on the Lagoon shore of the island was seen the portions of a vessel which had been many years a wreck. Scattered along the outer shore were many redwood logs, some of them of great size.

45. In April, 1869, an abandoned junk was stranded on Adakh, one of the Aleutian Isles.

46. In 1870, in October, the San Salvador ship *Louisa Canovera*, Captain Demoro, when in lat. 37° 46′ N., and long. 158° 10′ E., fell in with a dismasted junk, laden with rice, having four dead bodies on board, and no living persons. The papers and effects were taken and delivered to the Japanese Consul at San Francsico, and by him returned to Japan, November, 1870.

47, 48, 49. In July, 1871, the old chief at Attu Island, aged 70 years, reported that three Japanese junks had been lost upon the surrounding islets, during his recollection, besides one stranded not far from the harbor of that island in 1862.

50. In 1871, February 2d, in lat. 33° 45′ N., long. 141° 31′ E., about 150 miles from the coast of Japan, the American ship *Annie M. Smull*, Captain Packer, fell in with the Japanese junk *Sumi-yoshi-maru*, of Kiushiu, and rescued the Captain and three surviving seamen, and landed them at San Francisco, February 24, 1871. They sailed from Shiroko, province of Ise, January 17, 1871, for Dai Osaki, with a cargo of wood. Two days later they were disabled, and drifted to sea, and were picked up seventeen days later.

51. In 1871, May 23d, in lat. 34° 54′ N., long. 143° 32′ E., Pacific Mail steamship *China*, Captain Cobb, rescued five Japanese seamen from the disabled junk *Sumi-ayee-maru*, of Kobe. Eleven out of sixteen originally on

board died upon the wreck, and the captain of the junk died on the steamer after being rescued. They were cared for by Mr. Brooks, who returned them to Yokohama, July 1, 1871, and the government presented suitable rewards.

52. In 1871, the Japanese junk *Jinko-maru*, of Matsaka, of 180 kokus measurement, encountered a severe gale January 18, 1871, while going from Isé to Kumano, during which she lost her rudder, and while in danger of foundering cut away her masts. The junk drifted from the coast of Japan in the Kuro Shiwo for 2,500 miles in a helpless condition, her crew keeping a fire and living on rice, and fish they speared, until they drifted on the rocks at Atka, July 10th, 1871, where, by means of ropes, the three men on board landed safely. There they remained until September 19th, 1871, when they took passage by schooner *H. M. Hutchinson* for Ounalaska and San Francisco, whence they were returned to Japan by the Consul.

53. In 1873, Captain W. B. Cobb, in steamer *China*, rescued the crew from a wrecked junk in lat. —° —′ N., long. —° —′ E., and landed them at Yokohama, in acknowledgment for which the usual present was made him by the Japanese government.

54. A junk has been reported as stranded on the coast of Alaska.

55. A junk was cast upon the windward side of Kauaii, one of the Hawaiian Islands, and the survivors landed at Hanalei harbor.

56. An old resident of Petropaulski informed me there was a Japanese junk stranded below that harbor, previous to 1812, where many years since the wreck still remained. Six of the crew survived.

57. A Japanese wreck was sighted adrift below San Diego. Reported in the *Alta*.

58. A junk was wrecked at Nootka Sound.

59. In 1875, April 6th, in lat. 38° 02′ N., long. 164° 38′ E., American ship *Game Cock*, Capt. T. C. Stoddard, fell in with the Japanese junk *Woonohi-maru*, of about 80 tons, dismasted, with her stern stove and rudder gone, and generally in a helpless condition, and rescued therefrom twelve Japanese seamen. The junk was bound from Hakodaté to Tokio, with a cargo of salt fish and sea-weed, when on December 3d they were blown off shore in a severe gale. December 10th they again made the land, when another heavy gale commenced and blew the junk off again. December 19th was forced to cut away the mast to save the hull. December 22d raised a jury mast and got under way, sailing towards Japan whenever the wind permitted; at other times took in sail and drifted. By their reckoning, they estimate having thus sailed 1500 miles west, principally with northeast winds, when, April 5th, in a bad sea, they carried away rudder, and soon after stove stern. At 8 A.M. the following day, they abandoned the wreck, from which they were rescued by the *Game Cock*, and landed at San Francisco April 28th, and were returned to Japan by Mr. Takaki May 1st, per *Great Republic*. For the rescue and kind treatment of these men, the Japanese Government presented Capt. Stoddard with a gold chronometer watch through His Excellency Yoshida Kiyonari, their Minister at Washington.

60. In 1876, July 3d, in lat. 37° 10′ N., long. 167° 35′ E., British barque *Abby Cowper*, Capt. Nelson, fell in with the Japanese junk *Koki-maru*, of Otaru, island of Yeso, of 477 kokus government measurement, equivalent to

about 120 tons. The junk was dismasted and floating in a helpless condition. Sakaki-bara Katsubé, mate, and Tomokitchi, sailor, the only survivors of 12 men, were rescued from the wreck, and made the following statement, which is very interesting as an illustration of many doubtless similar struggles. In October, 1875, the junk loaded at Shari and Abashiri, on the northern coast of the island of Yeso, with salted salmon and preserved roe of salmon. Left latter place November 5th, and touched at Hakodaté, whence they sailed December 6th for Tokio, Niphon. On the 9th, when on the east coast of Japan between lat. 39° and 40° N., and about long. 142° E., a severe westerly gale was encountered. December 12th carried away mainmast. Afterwards got it in and fished it with a piece of the main yard. On the 18th carried that mast away, and the yard was washed overboard. A sea soon after disabled the rudder, which was unshipped and taken in, the vessel in the meantime making water freely. To lighten her, 300 kokus of cargo (nearly two-thirds), was thrown overboard. From this time the vessel floated helplessly.

Early in January, 1876, fresh water gave out, and all the rainwater possible was saved and used. Then three seamen were taken down with the scurvy, which soon appeared among the balance. Towards the close of January, firewood gave out, but a small nucleus of fire was preserved in a stove. As a last resort, the junk's boat was broken up for firewood. All hands subsisting on a little rice cooked in rain water, and principally on salt fish, with a very small allowance of water. February 5th Chojero died—the first death. March 9th, Capt. Sato Sangoro died; then followed Kitsaburo, April 16th; Bunkichi, 21st; Kizo, 24th; Renkitchi, May 2d; Skedjero, 2d; Taské, 2d; Heihichi, 14th, and finally, Matsutaro, June 10th. The two survivors, anticipating a similar death, lingered until the forenoon of July 3d, when they sighted a vessel, had strength enough to raise a signal, and were rescued. They caught rain May 24th, after nearly all had died, which largely assisted in preserving the survivors. They also caught fifteen large fresh fish called *bonita*. Before the captain died, he wrote and handed to the mate letters to his family and owners, describing all details. The two survivors, expecting death themselves, boxed these up, with the ship's papers, and fastened them in a conspicuous place, whence they were taken and preserved. After the death of each person, the survivors enclosed their bodies in a Japanese coffin suitably inscribed, and stowed them in the hold of the junk, hoping they might reach some land and receive burial. The survivors reached San Francisco August 15th, 1876, and after recuperating, were returned to Japan by Mr. Takaki.*

Many more might easily be added, but these suffice to establish many facts valuable to science.

The annual rainfall of Japan averages 70.33 inches, occurring on 197.7 days, two-thirds of which falls between April and October; at Tokio the thermometer varies from a monthly maximum of 91° Faht. in August, to a minimum of 20° in January, averaging 58° 22 for the year, and averages 48° 33 at Hakodaté, where the average number of hard gales per annum is 16.79. [See Kaitakushi Reports and Tables, Tokio, 1875.]

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*—NOTE.—These last two cases have been submitted by Mr. Brooks as additions to the list for publication since the reading of this paper.

The presence of wrecks so far south near the equator, indicates that they had been swept northward from Japan by the Kuro Shiwo, and thence southward along the northwest coast of America until they fell into the equatorial westerly current, where, in company with redwood logs, and drift-wood from Oregon, they must have reached these islands in the equatorial belt.

In illustration of this equatorial current, we have the report of residents of Christmas Island, which speaks of a westerly current setting past that island at the rate of one and a-half to two miles an hour. August 23d, 1861, there was picked up on the shore of the island of Niihau, in latitude 21° 50′ N., longitude 160° 15′ W., a bottle containing a paper, thrown from the American ship *White Swallow*, thrown overboard July 21st, 1861, in latitude 21° 30′ N., longitude 151° 55′ W. It had made a nearly due west drift of 460 miles in about thirty-three days. This shows the existence of a very powerful westerly current around the Hawaiian Islands of about 14 miles per diem.

In 1862, September 10th, an enormous Oregon tree about 150 feet in length and fully six feet in diameter above the butt, drifted past the island of Mauii, Hawaiian Islands. The roots, which rose ten feet out of water, would span about 25 feet. Two branches rose perpendicularly 20 to 25 feet. Several tons of clayish earth were embedded among its roots. Many saw-logs and pieces of drift-wood came ashore in this vicinity about this time. These were evidently portions of the immense body of ship-timber launched upon the Pacific during the great flood of the previous winter along the American coast. Their almost simultaneous arrival at Mauii in September, seems to indicate quite accurately the force and direction of the currents in this ocean. Supposing them to have come from the Columbia River, leaving say February 18th, 1862, and to have drifted 2,800 miles, they must have drifted at an average rate of 14 miles per day to have reached Mauii September 10th.

We may argue from the above that there were other ways of explaining the similarity of flora upon many islands of the Pacific and the high terraces of our Sierra Nevada mountains, beside the hypothesis of an intervening continent where the broad Pacific now rests.

There is a strong presumption that the present bed of the Pacific Ocean may once have been an extended valley, submerged by some abrupt and spasmodic catastrophe, at a period when the fiery interior of the earth was in a state of inconceivable agitation, and its equilibrium temporarily disturbed. Abundant ruptures of the entire combined strata of its crust along our mountain ranges, bear indisputable evidence, in prominences tilted up and raised to immense heights: conditions which must have necessitated corresponding depressions, and consequently established new beds for water, forming new islands, re-dividing and re-shaping continents. The existing shore lines of enormous empty basins, the pebble and cobble stones rounded by erotion, at present in the centre of this continent west of the Rocky Mountains, all contribute testimony of some great change.

The spores or seeds of plants may, however, have been more recently transferred by clinging to the earth around the roots of such mammoth trees as floated from the high latitudes of the northwest coast of America. Once cast upon any island and rooted, they would soon replant and extend themselves. Driftwood from Columbia River and Puget Sound distributed itself

throughout the North Pacific, and the windward shores of the Hawaiian Islands are literally lined with it, as well as with redwood logs of formidable size.

Small parties of male Japanese have repeatedly reached the American continent by sea, cast upon its shores after floating helplessly for months. Until recently, the survivors must have remained permanently near where they landed, and naturally uniting with women of the native races, have left descendents more or less impressed with their physical peculiarities. Such a slow, limited, but constant infusion of Japanese blood, almost entirely from male seamen, was undoubtedly sufficient to modify the original stock of all coast tribes along our north-western shore. No marks exist of any immigration *en masse*, neither is there any present record of any Japanese woman saved from such a wreck, although cases may formerly have occurred, but must have been very rare. These unfortunate seamen, often illiterate, and separated from their sources of learning, necessarily lost their own language; but in doing so, doubtless contributed many isolated words to the Indian dialects of this coast. Many shipwrecked Japanese have informed me that they were enabled to communicate with and understand the natives of Atka and Adakh Islands. Quite an infusion of Japanese words is found among some of the coast tribes of Oregon and California, either pure, as *tsche-tsche*, milk, or clipped, as *hiaku*, speed, found reduced to *hyack*, meaning fast, in Indian; or *yaku*, evil genius in Japanese, similarly reduced to *yak*, devil, by the Indians. In almost all words showing such similarity, the Indian word is always an abbreviated word, or shorter word than the Japanese, from which it may be argued that the latter was the original and the former derived. The construction of the two languages is, however, different. There are, however, a large number of pure Japanese words and some very peculiar Japanese "idioms, constructions, honorific, separative, and agglutinative particles" found nearly identical in the American-Indian dialect. Shipwrecked Japanese are invariably enabled to communicate understandingly with the coast Indians, although speaking quite a different language. The great mass of the Japanese people stoutly disclaim any common descent with the Chinese, and firmly believe they have a wholly different origin. Any common ancestor must certainly have been in very remote ages.

Professor George Davidson, in charge of the United States Coast Survey on the Pacific, our highest authority upon questions connected with the great ocean currents of this ocean, has bestowed much critical study upon the physical conditions connected with the Kuro Shiwo. In 1851, when stationed at the mouth of the Columbia river, he began the interesting investigations necessary to demonstrate its complete outline.

In 1868, he communicated to the National Academy of Science his deductions establishing the existence of the return current northwestward, westward and southwestward along the shores of the Gulf of Alaska, and the southern coast of the Aleutian Islands, whilst the great body of the current is deflected down the northward coast until it is drawn into the Great Equatorial Current which moves westward until it strikes the Asiatic barrier, and thence starts on its course, about the island of Formosa, as the great warm stream of Japan. He first showed the striking analogy between this stream and that of the

North Atlantic, especially in their origin at latitude 23°, their being nearly 180 degrees of longitude apart, their general course, etc., etc.

There is a branch of the Kuro Shiwo, which shoots off northward near Kamschatka, and is felt 50 or 100 miles off this promontory; whilst close in shore, a cold current flows southward from the Arctic through the western part of Behring's Straits. On Kamschatka, the Kurile and Aleutian Islands, and on Alaska, great number of disabled Japanese junks must have been stranded in past centuries.

Professor Davidson, who has had occasion to examine the Spanish, English, Russian and American records of discoveries in this ocean, assures me that he has found mention of at least a dozen or more junks, wrecked on the coasts of Kamschatka, within a comparatively recent period; and in the earlier descriptions of the Kurile Islands, and of the Kamschatka Peninsula, he says frequent mention is made of the wrecks of Japanese junks upon these coasts.

Both winds and currents of the North Pacific assist in driving disabled Japanese junks around the great circle of the Kuro Shiwo. A junk disabled in the latitude of Tokio would be swept by alternate southwest and northwest winds, and the existing northeasterly current, towards the northwest coast of America. The distance from Cape King to San Francisco is about 4,500 nautical miles. We have here abundant proof of the track taken by these disabled vessels, by a study of their positions when found drifting at sea in the Pacific, at the mercy of winds and waves.

For many, many centuries the coasting trade of Japan has employed a large fleet of junks in exchanging rice from their southern, for salt fish from their northern ports. Although it may be presumed that the large number of their vessels thus disabled and rendered unmanageable, undoubtedly founder in the heavy gales they experience; yet comparatively large numbers having cargoes suitable for food, and crossing a region subject to much rain, which is easily caught, are enabled to sustain life until either picked up, or stranded somewhere on the American coast, or some island in their course.

In the above sixty cases enumerated, there were, from 1613 to 1694, four cases; from 1710 to 1782, three cases; 1804 to 1820, six cases; 1831 to 1848, eleven cases; and since the rapid settlement of this coast in 1850 to 1876, only 28 years, we have a list of 36 wrecks reported. This apparent increase is not owing to their increased number, but solely to the fact, that increase of commerce on the Pacific has distributed there a large fleet, whose presence has materially increased the chances of rescue to disabled vessels, and the likelihood of receiving reports from stranded wrecks.

In addition to the list we have enumerated, are the Hawaiian traditions that *several* such junks were wrecked on Hawaii before the year 1778; to which add the wrecks from which the 18 Japanese were returned from Honolulu in 1834, also those from which came the junk full of shipwreck Japanese, who attempted to, and failed in returning, by Cheefoo to Nagasaki; also the dozen additional ones, alluded to by Professor Davidson, as stranded on the peninsula of Kamschatka, within a comparatively recent period; and the frequent mention of similar wrecks on the Kurile Islands. These all taken together, with yet others not fully verified, could scarcely have been less than forty

more, rendering it reasonable to suppose that fully one hundred wrecked Japanese junks, have been heard from, in one way or another, adrift upon the North Pacific, or stranded on the northwest coast of America or some outlying islands.

In answer to the question of whether any of these waifs have ever found their way back to Japan from the American coast. in early times, I can say, that from historical data still extant, and from the personal relations of descendants of some of such returned voyagers, I have learned that in rare cases, occurring from 400 to 260 years ago, crews actually reached Japan with tidings of the American coast; and Professor Davidson informs me, that when recently in Japan observing the Transit of Venus, a very intelligent Japanese scholar, well known to me personally, related to him a well authenticated case within this century. Formerly such accounts were not allowed general publicity, because stoutly discountenanced by an ecclesiastical government, to whom such discoveries were quite as repugnant as were Galileo's to the medieval government of Rome. To the peaceful masses, the confines of their archipelago, were but recently the horizon of the world.

The famous voyage of the Buddhist priest from China, at the beginning of the seventh century, to a country called by him Fusang, (meaning, translated "to aid or cultivating mulberries,") was at the exact period when Japanese historians record their first official intercourse with China; and was probably reached by a coasting voyage along the western coast of Corea, thence along the northern coast of Niphon, around Yeso, and southerly, to the southeastern shore of Niphon, where mulberry trees were then cultivated abundantly, and which was undoubtedly the land he called Fusang. A careful study of the native records seems to indicate that his much mooted Chinese voyage could not possibly have extended to the American coast.

Of the sixty cases here reported, 27 wrecks were encountered at sea, and the balance stranded, as follows: On the Aleutian Islands, 8; Coast of Kamschatka, 6; Alaska, Oregon, Hawaiian and Brooks Islands, two each; Off San Diego. Acapulco, Nootka Sound, San Bonito, Queen Charlotte, Cedros, Providence, Baker's, Stapleton, Ocean and Ladrone Islands, one each.

In 23 cases where the actual number on board was named, they aggregated 293 persons; an average of 12¾ persons to a junk; ranging from 3 to 35 in individual cases.

Where definite statistics of the saved are given, we find 222 persons saved in 33 cases; an average of 6¾ persons in each disaster. On eight occasions, three persons each were rescued; in four cases, one person; and on four other cases, four persons; three times, eleven were saved; and twice each, 5, 12, 15, 17; and once each 2, 6, 7, 9, 10, 13, were saved.

By an examination of the above figures, we may estimate the probable extent of Japanese blood infused into the Indian tribes around the shores of the North Pacific.

Fifteen vessels mention having drifted helplessly at sea an aggregate of 106½ months, averaging a little over seven months each.

Eleven cases report 122 deaths; averaging a little over eleven deaths to each wreck.

It is sincerely hoped that the publication of this record, which has so interesting an ethnological import, may result in awakening Japan to the adoption of immediate steps in the great interest of a common humanity; for by improving the models of her vessels, and adopting those with sea-going qualities, this long record of disasters may speedily be abridged, if not wholly terminated.

About a year since it became my duty to forward to Japan, half a dozen wooden models, full drawings and specifications of small vessels, varying from 40 to 200 tons, ordered by the Japanese government for the use of shipbuilders, which the now enlightened government has recommended them to adopt, instead of their present form of junks. Thus the edict of 1639 has passed away forever, and young Japan is rising to take her equal place among the advancing nations of the world.

Few are better aware than the scientist, of the manifold and inevitable dangers which attend all radical changes, when suddenly made; for success is a problem seldom solved without repeated trials and inevitable failures. But to-day, Japan is earnestly seeking to establish her national perpetuity, by fostering a discriminating intelligence among her people, and by encouraging general and liberal education among the masses. Thus she reverses in the most practical manner, the other edict alluded to as promulgated in 1637. Her centuries of quiet seclusion are now embalmed with the history of the past, and she seeks true greatness in an enlightened administration of her national affairs, and bids fair henceforth to reciprocate a generous friendship towards all members of the great brotherhood of nations, from whom she may now claim equal sympathy and neighborly protection.

The great changes in Japan can not be better illustrated than in the fact, that it is now customary for the government of Japan, in common with all other nations, to present through their Foreign office, some suitable reward in acknowledgement of kind service, to the captains of vessels who rescue their shipwrecked seamen.

The Japanese Government have now in their navy ten war ships, five dispatch vessels, and five training ships, all steamers; and in their mercantile marine, one hundred and two steamers of various tonnage, aggregating 30,718 tons; also 32 modern sailing vessels built in foreign style of 7,346 total tonnage.

The great Pacific Ocean and its adjoining waters, under the impulse of this age of steam, is becoming the highway of an enterprising commerce, and steadily unfolds an attractive field of research to ethnological and linguistic archæologists.

Many young Japanese are already attracted to scientific pursuits, and their valuable technical as well as general results, are beginning to claim the attention of naturalists.

Much valuable scientific work has been done by Japanese scholars since their early lessons received from Professor Wm. P. Blake and Professor Raphael Pumpelly; two eminent American scientists, whom I had the honor

of selecting and engaging in the summer of 1861, on behalf of the government of Japan, to act as government Mineralogists and Mining Engineers.

A glorious opening now presents itself for some reliable and competent scholar, with pecuniary means at command, to collect a library of books relating to the Asiatic shores of the North Pacific ocean, as perfect in its way as is that of our great historian, Hubert H. Bancroft, relating to the native races of the American coast; and when as systematically classified, and as thoroughly studied, give to the world full and correct historical details and analytical classifications of all native races on the borders of Asia; many of whose records and traditions must necessarily fade with radical changes in civilization, and soon pass beyond human reach.

The splendid sunrise, now dawning in the Orient, offers golden opportunities, which should be promptly improved while available. Old ways are giving place to new, and invaluable treasures of antiquity may be lost forever, or cast aside to linger for a generation or two, in the memories of the aged, before their shadowy forms become enshrouded in the misty veil of a forgotten past.

Dr. Stout referred briefly to the death of Sir Charles Lyell, and a Committee of three was appointed to draft appropriate resolutions. The Chair appointed John Muir, H. G. Hanks, and Dr. A. Kellogg.

Regular Meeting, March 15, 1875.

Vice-President Gibbons in the Chair.

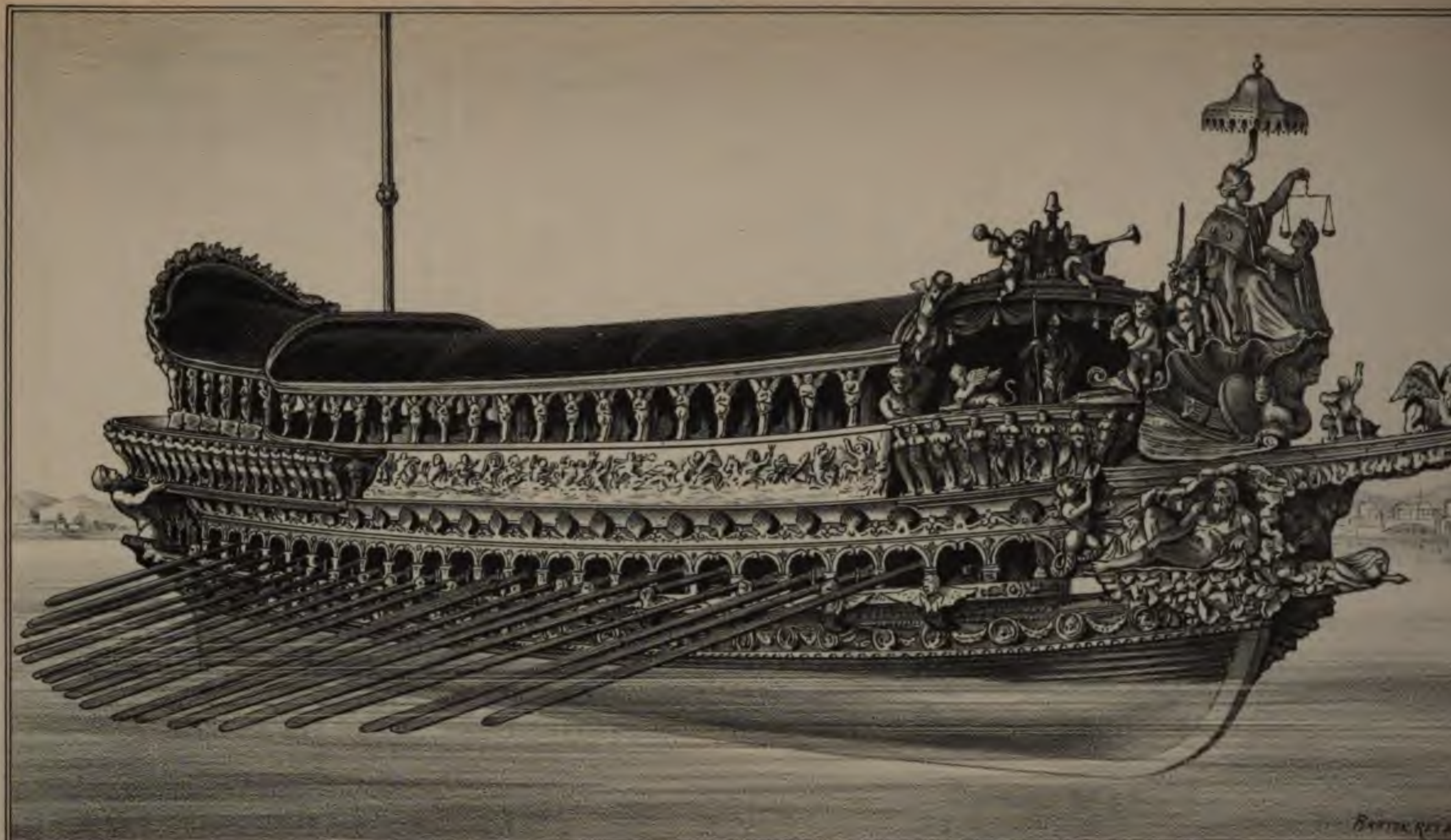
Twenty-two members present.

Henry R. Taylor and J. W. Anderson were elected resident members; and Arthur C. Taylor was proposed.

Donations to the Museum: From John Muir, lava from Mt. Shasta; also specimens of *Pellea ternifolia* and *Cupressus McNabiana*.

Mr. Amos Bowman read a paper on Terraces in the Coast Range as related to the detritus of glaciers and of the ancient rivers.

Charles Wolcott Brooks read the following paper:



THE BUCENTORO, A STATE GALLEY OF VENICE.
gilded from prow to stern, and covered with a canopy of silk. A.D. 997–1797.

Early Migrations—Ancient Maritime Intercourse of Western Nations before the Christian Era, Ethnologically considered and Chronologically arranged, Illustrating Facilities for Migration among early types of the human race.

BY CHARLES WOLCOTT BROOKS.

In all subdivisions of races, we are apt, at first, to look superficially upon different nations as separate and complete types of humanity. The brief synopsis here collected from ancient histories, clearly reveals the extent of maritime intercourse, actually developed by western nations up to fully 4,000 years ago. By such statistics, acquired with sufficient details to trace facilities for admixture, the inference fairly follows: that maritime nations of Asia, including the Japanese, whose origin we are soon to examine, may have enjoyed like facilities of intercommunication; and consequently, in common with all maritime peoples at this stage of human existence, became to a certain extent mixed and composite.

Until we reflect, we know not the possibilities of human nature. The exact justice of all nature's arrangements, and the unerring actions of her laws is exhibited in her method of developing man. He is carniverous, hence combative; gregarious, therefore social. This is equally true of individuals and of nations. If we follow out this thought, we shall find man, even in his perturbations, is a creature of law.

All matter is similar in substance, differing only in degree of development. The refinement of matter is a process ceaselessly going on in the Eastern as well as in the Western hemisphere; for the parental law of physical and mental formation, and progressive development is universal, coëxtensive and coëval with nature, No solitary world or people has a special code of laws. God, the controlling power, is law, impartial and universal. Man is the highest physical ultimate of matter endowed with a progressive principle. To him, religion is a grand, progressive, moral science, unfolding his physical and mental qualities by exact and eternal law. It everywhere teaches him that the aspect of all created things is continually changing, and in obedience to law he *must advance*, for all present conditions periodically perish. With constantly changing conditions, an endless evolution of forms and ideas is ceaselessly occurring.

Nature is everywhere instinctive with life; attractive and repulsive forces are exerted over atoms and bodies, and equally over minds. These, in the latter case, influence migrations. Capricious influences often intervene to determine direction; for nature works by greater or lesser impulses, yet her methods determined by law, are always adapted to the end in view, to the plan of the Great Architect, the Intelligent Mind of the Universe.

Perfect arrangement and maturity of plan marks the order of creation. Life is to unfold, cultivate and develop our rudimentary powers. Every atom bears its own record. Our own soul is the parchment, whereon is indelibly engraved our virtues and our vices. Action and rest succeed one another. Periods of intense activity are succeeded by others, either dilatory or inert, when action gradually subsides. The world is now entering a period of great popular activity.

Language is inadequate to convey a perfect idea of a spectacle, open to the analytical eye of every observing naturalist; sublime as it is wonderful, exact as it is impartial. All things are subservient to exact law, and similar conditions lead to similar results. An elementary study of the early intercourse among so-called western nations, seems imperative to those who would seek to unravel a corresponding movement among aborigines of the far East.

The independence of thought and action, which this age has developed, precludes the acceptance of any theory by the educated classes, which is not in accordance with nature and reason. Only by practical illustrations can we properly comprehend nature's intricate principles and processes. Science says: prove all things, all truth is susceptible of proof.

Although many individual instances here quoted may be familiar to scholars; their ethnological value is especially apparent when massed in one collection, where they show early intercourse to have been habitual rather than exceptional, revealing the probability as well as the possibility of very early admixture of races, and finally elicit testimony to establish a certainty.

From the earliest dawn of human history, tribes and nations appear to have been more or less mixed, either when captured as prisoners of war, like the Sabine women of Rome, or united in friendly alliance for purposes of commerce. General communication, here shown to have extensively occurred during the early stages of human development, naturally implies that all early races brought in contact by commerce, have to a certain extent, mutually left their impress upon each other.

Before submitting the ancient records of Asia to a scrutinizing search, we briefly trace the early footsteps of national intercourse in the histories of western nations. Gradual progression marks the development of commerce, from the rude attempt of the ancients to follow their coast with primitive galleys, having solitary mast and sail, or oars double or treble banked, to the dauntless energy of ocean steamships at the present day. Slowly but surely commerce is raising inventive genius above the fame of military chieftains, and enabling Watt, Fulton, Arkwright, Whitney and Morse, to claim a greater share of our true admiration, than agents of destruction like Alexander, Cæsar or Genghis khan.

Maritime commerce, which exchanges what a nation can spare from its abundance, for what it wants, is of very ancient origin, and may have had its beginning in the unrecorded era, nearly coëval with the development of intelligence in man.

The study of astronomy, a science essentially necessary to ocean navigation, was very ancient among oriental nations. Learned astronomers are persuaded that the celestial observations of the Chinese were accurately taken B. C. 2249; those of an eclipse, B. C. 2155, have been proved as authentic, and

other observations are recorded three centuries later. Astronomical observations made at Babylon, calculated the rotundity of the earth, which they estimated at 40,000 miles in circumference; and those when transmitted to Greece by Alexander, and seen by Aristotle, B. C. 324, contained a calendar of above nineteen centuries, extending back to within fifteen years of those ascribed to the Chinese. Europeans first learned this science from Jupiter Belus, king of Babylon. The ancient kingdoms of India appear to have had observations fully as early as the Babylonians.

We will now attempt to trace chronologically the naval growth and ancient commerce of western nations by their records, from B. C. 2249 to the Christian era, to demonstrate the possibility of early migrations of races in prehistoric times. Migrations by water, which appear by our own histories to have occurred around the Mediterranean, may likewise have occurred on the Pacific, and in other parts of the habitable globe. Shore lines and water courses were early availed of for the distribution and subdivision of races. Mountain ranges were natural barriers.

The authenticity of ancient history necessarily rests upon the evidence of ancient writers, when unimpaired by later discoveries. This summary has therefore required a judicious digest of many original authors, from whom its statistics are compiled and arranged.

Few seem to be aware of how early and extended an intercourse existed between Asia and the western world, which in its earliest ages was principally conducted by the South Arabians, a people apparently more enlightened by science and commerce than any nation farther East except the Phœnicians.

The South Arabian commerce is supposed to be the most ancient intercourse between far-distant peoples, of which western nations have any remaining records. That next in importance, and apparently also in order of time, was that of the Phœnicians and their colonies, especially Carthage and Gadir (changed by the Saracens to Cadiz). Those general enemies of commerce, the Romans, soon abolished that of Cathage and of Corinth. With the increase of the Roman empire came the decrease of commerce, excepting only that branch necessarily enlarged by an increasing demand for Oriental luxuries. Of this very early trade of the Europeans and nations of Asia Minor, with the Orient, we happily possess a description which, for accuracy and minuteness of detail, when compiled, may almost rival a modern official account.

As the Roman empire declined, the Oriental trade, supported merely by the redundant opulence of Rome, gradually decayed; and in the sixth century we find the intercourse with India turned into a new channel. During the many dark ages which succeeded the subversion of the western empire, gross ignorance prevailed, and commerce, in common with literature and science, became neglected in the western hemisphere, until renewed attention was drawn to it by the Saracens, and at some of the Italian seaports. The spirit of commerce afterwards arose in the Netherlands and at some German seaports, followed by Pörtugal and Spain, and latterly by Great Britain and other European nations.

The Greeks esteemed Phœnicians as the inventors of commerce, shipbuilding, navigation, and the application of astronomy to nautical purposes; their

capital, Sidon, founded about B. C. 2200, became preëminently great and illustrious for the wonderful energy of its people, but it is presumed that commerce was received by the Phœnicians from the Babylonians, and in turn found its way there from Indian countries farther East, along the Asiatic shore and Malayan archipelagoes.

That Persian poem, the book of Job, generally admitted to be the oldest book in the Hebrew bible, shows that sciences were then cultivated, ship-building, useful and ornamental arts, were in an advanced state, and commerce was vigorously prosecuted. Vessels are spoken of as distinguished for their speed, bringing gold from Ophir, and topazes from Ethiopia.

B. C. 1728, the Arabians conducted an extensive and profitable trade between Egypt and India, importing largely of spices, gold and silver; and it is recorded, B. C. 1556, that vessels were propelled by fifty oars. This custom continued, and in later history we find their size increased, and they were furnished with three, and at times five, tires of oars.

The early history of Greece shows their vessels were Phœnician built, rowed by oars—long, slender, open boats, lightly constructed, capable of being transported upon shoulders, the smallest carrying 50 men, the largest 120—and although they had masts and square sails, they depended mainly upon their oars. Seventy geographical miles was considered a day's work for a vessel with oars, and the sailors were paid four *oboli*, or about eight cents a day.

Much of the early Greek mythology came originally from India. There is scarcely anything the Greeks ever learned from the far Orient, the invention of which they have not ascribed to their own countrymen. Many of our best scholars, aided by recent discoveries and researches, are now persuaded that the use of letters was known to the Greeks before Cadmus came from Phœnicia, B. C. 1556. The earliest letters known in Greece were more probably those which Plato calls Hypoborean (i. e. northern), and describes as different from letters of his own age. According to Diodorus Siculus, Orpheus used Pelasgic letters, which were older than the Greek.

Strabo says: the invention of rafts, the very first rude essays in navigation, was ascribed to Erythras, a king of some part of the coast of the Persian Gulf. Theophrastus is, I believe, the oldest author who alludes to cinnamon and other spices and aromatics, knowing them to be the produce of India. Intercourse between India and Arabia was easy by availing of the monsoons, whose periodical regularity were observed and taken advantage of, to bring cargoes of spices many ages before the time of Hippalus, whom the Egyptian Greeks supposed to be their first discoverer. The Southern Arabs traded to more remote parts of India than the Persians or Assyrians, and from the earliest ages enjoyed most generally the entire monopoly of the trade between far India and the western world. It was not until Europeans found an ocean route to India via the Cape of Good Hope, that the ancient system of their most important commerce was totally overturned.

This commercial history is quoted as showing how common and easy was the migration of colonies by sea in remote ages, and how great an ascendency the possession of shipping and maritime power gave to some of the pre-historic races. In very early times the Phœnician merchants were the greatest

ocean carriers for the whole western world. B. C. 1280, the spirit of trade is recorded as having spread over the greater part of Asia.

The religion of Egypt declared the sea unclean, because the dead body of their god Osiris was thrown into it. Egyptians therefore abhorred the sea, and formerly avoided any concern in maritime affairs. Their early trade was conducted by foreigners; on the Mediterranean and with Arabia, their commerce was for a long time wholly entrusted to the Phœnicians. According to Apollonius Rhodius, B. C. 1300, and prior to the expedition of the Argonauts, Sesostris, king of Egypt, built a fleet of 400 vessels on the Erythræan (Red) Sea. The Egyptians were, however, but fresh-water sailors; their hulls and masts were made of *thorn*, and sails of paper.

The Greeks had skillful ship-builders, and Homer has immortalized Harmonides as the builder of the vessels which carried off the beautiful Helen from Sparta. During the "heroic ages" of Greece, the petty princes on the sea coast frequently fitted out vessels to go on piratical cruises against the merchant ships upon the Mediterranean; hence it became common to question a commander whether he professed piracy or trade.

Their course depended on the previous knowledge of the shore acquired by some member of the crew. Homer describes Ulysses as covering his ship with long planks, making probably a half-deck.

B. C. 1194, when Paris carried off Helen, wife of Menelaus, king of Sparta, Agamemnon, king of Argos, embarked a Grecian army of 100,000 men in a fleet of 1186 vessels to avenge the affront.

Castor, of Rhodes, a writer cotemporary with Julius Cæsar, made a catalogue of nations who successively attained the empire of the (Mediterranean) Ægean Sea. B. C. 1280, the island of Crete was called by Aristotle the Empress of the Sea. B. C. 1179, the Lydians, after the Cretans, were honored by Minos with the title of masters of the sea. B. C. 1058, the dominion of the sea is ascribed to the Pelasgi. B. C. 1003, Castor alleges the Thracians had the *Empire of the Sea*, and held it 19 years. B. C. 890, the dominion of the sea is ascribed to the Phrygians. B. C. 753, the Milesians are represented as supreme in naval power, and having a wide commercial fame. B. C. 734, the dominion of the sea is ascribed to the Carians, buccaneers, noted for their piracies. B. C. 717, the Corinthians, a nation of Greece, made a considerable figure in naval transactions. Thucydides mentions their naval force soon after the Trojan war, kept up to protect their trade against pirates. B. C. 676, the Lesbians obtained and held command of the sea for 59 years. B. C. 67, the Romans were masters of the sovereignty of the sea without a competitor, having destroyed nearly all the mercantile nations.

B. C. 1100, the Phœnicians extended their discoveries along the entire northern coast of Africa and the opposite shores of Spain. The Mediterranean was no limit to their enterprise, for they passed the Pillars of Hercules (Gibraltar) and established powerful commercial settlements upon the Atlantic, mutually beneficial to themselves and natives of the country. Phœnician colonies were societies of opulent and intelligent merchants, ingenious manufacturers, skillful artizans and hardy seamen, who left an overcrowded population, with the good wishes of their parents and friends, to settle in a distant country and there maintain a correspondence for mutual advantage.

B. C. 1046, Eupolemus says David built ships in Arabia, wherein he sent men skilled in mines and metals to the island of Ophir.

B. C. 1012 and 975, Solomon extended his territories to the Red Sea, and despatched ships to the rich countries of the South and far East. Hiram, king of Tyre, wishing an opening to the rich commerce of the Orient, either acted in partnership or concert with him.

Previously all Oriental products had been received at second-hand through the Arabians. Solomon's ships, built and conducted by the Tyrians, sailed in company with those of Hiram to the rich land of Ophir and Tarshish. A voyage required three years to accomplish, and the returns were prodigiously profitable, consisting of gold, silver, precious stones, ivory, woods, apes and peacocks. They probably availed of the monsoons to visit Ceylon, Sumatra, India, and possibly communicated with China and Japan. The Phœnicians, when in the Indian Ocean in company with Solomon's fleet, doubtless saw the beautiful Malay prows, and reported and improved upon the former models of their vessels, and multiplied their oars or paddles.

B. C. 916, the Rhodians composed a Code of Maritime laws, which was copied by the Romans, and ingrafted into the law of Oberon, which is in a great measure in force to this day. They were of Phœnician origin.

B. C. 890, the Greeks received from Asia coined silver money, weights and measures.

B. C. 717, the commercial city of Tyre was attacked by Salmanasar, king of Assyria, who brought against it a fleet of 70 vessels, furnished and manned by Phœnicians. The Tyrians defeated this fleet with only 12 ships, and took 500 prisoners. This is the most ancient naval battle recorded in European histories.

B. C. 700, great improvements were introduced into shipbuilding by the Corinthians.

B. C. 641, Colæus, of Samos, sailed through the Straits of Gibraltar to Tartessus on the southwestern coast of Spain, and was the first Greek who ever saw the Atlantic.

B. C. 616, Necos, king of Egypt, sent a fleet of discovery to circumnavigate Africa, engaging therefor Phœnician navigators who sailed by the Red Sea, and following the coast of Africa, returned by the Mediterranean, reaching home the third year after their departure.

B. C. 594, according to Diodorus Siculus, Apries, king of Egypt, had a fleet on the Mediterranean, and fought a naval battle against the maritime cities of Sidon and Tyre, the former of which he captured, beating the fleets of Phœnicia and Cyprus, and returned to Egypt loaded with spoils. As Egypt had no ship timber, most of the Egyptian fleets were built by, and purchased of, the Phœnicians.

B. C. 588, The Tyrians employed workmen from all neighboring countries to labor in building and navigating their ships, which were magnificently adorned with ivory, purple and fine linen; their commanders were most respected, and every commercial and maritime calling was esteemed honorable.

About this time, Thales, a Greek philosopher descended of Phœnician parentage, pointed out to the Greeks the *Ursa minor*, by which Phœnicians steered their course at night; instructed them in the rotundity of the earth; fixed the year into 365 days, and predicted the year of an eclipse.

Pythagoras, a native of the island of Samos, taught the rotundity of the earth, the existence of the antipodes, and a confused idea of the real motion of the planetary system as afterwards demonstrated by Copernicus.

B. C. 550, the Phœnicians visited Ireland, and returned with reports of the islands now known as Great Britain.

B. C. 543, we learn that the inhabitants of Phocæa, a Grecian city on the Asiatic coast, were a commercial people, and the first Greeks who traded to remote Asiatic countries; performing their voyages in long vessels of fifty oars, in the management of which they were very expert. Strabo mentions a colony of Phocæans who were expelled from Corsica, who sailed to the south of Gaul, where, B. C. 538, they founded Massilia (Marseilles), a city which about the Christian era, sustained a high character as the seat of science, commerce and naval power.

The Etruscans and Etrurians, says Didorus Siculus, founded colonies at a very early age, were good mariners, and appear to have possessed the greater portion of Italy before the Trojan war. Polybius says, B. C. 524, the Carthagenians were possessed of hereditary preëminence in nautical science. Their ships were equal to any on the Mediterranean, carrying carved figure heads and sterns. Aristotle says they were the first who raised their ships of war from three to four rows of oars. They constructed wet docks, and were first to appoint second captains (mates) to their vessels.

B. C. 524, the Carthagenians embarked 30,000 people in sixty ships of fifty oars each, and passed Gibraltar to the west coast of Africa to found colonies. These vessels must have carried 500 persons each.

B. C. 506, Darius, king of Persia, invaded the Scythians with a fleet of 600 vessels. Darius was also sovereign of Phœnicia.

B. C. 497, the Ionian fleet of 353 vessels was defeated by 600 ships belonging to the maritime vassals of Persia, chiefly under the direction of Phœnicians.

B. C. 494, an expedition, conducted by Mardonius, son of Darius, composed of 300 ships, containing 20,000 soldiers, was cast away against the rocks of Mount Athos during a violent storm.

B. C. 481, Xerxes, the mighty monarch of Persia and a greater part of Asia, sent a memorable expedition against Greece, composed of 1,207 *triremes*, or ships of war, carrying three *tires* of oars, and 3,000 transports, which formidable armada was finally defeated by the Greeks.

B. C. 477, Herodotus says, Amilcar a Carthagenian general, invaded Sicily with an army of 300,000 men. As Sicily is an island, this necessitated a naval fleet.

Frequent mention of large naval fleets transporting armies, is made from this date until the Christian era. From this time wide commercial intercourse existed,and many naval engagements of great magnitude are noted.

The commerce which had flourished for ages in the hands of the Phœnicians was largely desolated by the conquests of Alexander, B. C. 333.

B. C. 260, the Romans, who prospered for a while by a perpetual violation of justice, resolved to establish a naval force for piracy and commercial plunder. They had neither ship carpenters nor seamen, but got possession of a stranded Carthagenian *quinquereme*, and in sixty days from felling the trees,

their carpenters had constructed a fleet of 100 quinqueremes and 20 triremes. Roman sailors were drawn from the despised classes of the populace, and were unrespected, while the navigators and seamen of Tyre and Carthage were held by their people in high and deserved esteem.

B. C. 242, although the Romans had considerably improved in nautical knowledge, the progress of Science among them was very tardy, and their losses by storms at sea were prodigious. In one gale almost every soul perished on 384 of their ships, which either foundered or were wrecked. At the same time the Carthagenian fleet made a good harbor and escaped damage. The haughty Romans thought commercial concerns beneath their dignity, and that extended selfishness which they called patriotism, soon rendered it impossible for any mercantile nation to flourish within the grasp of Rome.

B. C. 219, superabundant wealth induced a rage for shipbuilding, among Hiero, king of Syracuse, and other opulent kings of his age, vastly exceeding every purpose of utility in enormous bulk and extravagant ornament. Assisted by Archimedes, Hiero constructed a galley of twenty tires of oars, sheathed with sheet lead, and carrying three masts, which no vessel had hitherto done. She had the embellishments of a palace with the fortifications and warlike stores of a castle. Athenæus tells us, on the authority of Callixenus and Mosepion, that Ptolemy Philopator, king of Egypt, built two huge ships. One intended for sea service was 420 feet long, 57 feet beam, consisting of two long flat vessels united by one deck, having two heads and two sterns. She carried 4,000 oars, disposed in 40 tires. Besides 4,000 rowers, she carried 2,850 soldiers, cooks, servants, etc. The other vessel, intended for inland navigation, was 300 feet long and 45 feet beam.

B. C. 170, the Sabæans, who possessed the southern extremity of Arabia, acquired great opulence by commerce, and preserved their liberty unimpaired by conquest during many ages. Agatharchides says they were in possession of the carrying trade between Asia and Europe, and commanded the commerce of both. They filled the dominions of Ptolemy with gold and silver and precious stones (probably from Ceylon), and founded several colonies in foreign countries.

B. C. 146, the Romans, determined upon the total abolition of commerce, destroyed the mercantile city of Corinth, and thought themselves entitled to the exclusive privilege of plundering the world.

B. C. 100, Strabo repeats a story of a vessel from India, picked up adrift in the Red Sea, with only one man aboard, almost dead, whose shipmates died of famine, and Ptolemy Eurgetes, II, king of Egypt during the Macedonian dominion, sent Eudorus to convey him back to India, whence the expedition returned with aromatics and precious stones.

B. C. 67, Pompey, with 500 Roman ships under his command, captured 400 ships at Cilicia.

B. C. 66, Lucullus, returning from Asia, brought as a part of his plunder, a large number of books.

B. C. 57, the Veniti, said by Strabo to be a Belgic nation, settled near the northwestern extremity of Gaul (France), were distinguished for their nautical science and experience. They had great numbers of vessels, excellent sea-boats, used leather sails, and iron chains instead of rope cables, and car-

ried on a considerable trade with Britain. Their fleet of 220 such vessels was overpowered and captured by a Roman fleet of 600 galleys.

B. C. 54, Julius Cæsar collected above 800 ships and landed a large force in Britain, subduing a great many kings, four of whom were in Kent.

B. C. 43, the profusion of luxury introduced into Rome by the conquest of enervated kingdoms of Asia, had now made alarming progress.

B. C. 25, ambassadors are said to have been sent by an Indian prince called Porus, from India to Rome, and, according to Florus, also from the Scythians, Sarmatians, and even the Seres, to court the friendship of Augustus, who was then in Spain. Those from India were nearly four years upon their journey. Augustus was called the father of the Roman imperial navy, of which Ravenna on the Adriatic was the principal eastern station, and Misenum in the gulf of Naples, the western. Pliny says, in his reign some Roman navigators explored the coast of the North Sea as far as Cimbri (the north end of Denmark). At this time the Britons used small vessels of which the keel and principal frame was made of light wood, the bottom and sides of a kind of basket work made of osiers, and the whole was covered with hides.

The Arabians, who furnished the greatest and most reliable part of articles imported into the Mediterranean, appear to have been the only traders from the West, whose voyages in very early days extended to India. In 1851, I met a small native Arabian vessel far from land in the Bay of Bengal, bound towards the Spice Islands of the Malay Archipelago—a notable relic of ancient times. People of such commercial and nautical knowledge as the South Arabians, could not have experienced the semi-annual changes of the monsoon, without early availing themselves of the advantages they offered to their navigation. It would by no means be extravagant to suppose that they traded to Taprobanè (Ceylon), or even to countries and islands far beyond it. As early as the days of Solomon (B. C. 1000), no such spices were known in Jerusalem as those presented by the Queen of Sheba; and later we learn in the days Ptolemy Philadelphus, B. C. 280, the Sabæans, whose long experience in the nature of the periodical winds called monsoons, of the seas and various ports of India, undersold the merchants of Egypt, who coasted the whole way to India in their own small vessels. Ptolemy sent Dionysius to India as Ambassador, with a view of establishing direct intercourse with that country.

In the "Periplus* of the Erythræan Sea," oriental vessels then in use are thus described: *madaratæ*, small vessels joined together by sewing; *trappaga* and *kotymba*, long vessels used by fishermen and pilots; *sangara*, piratical crafts like double canoes; and *kolandiophonta*, which vessels were of the largest size, with capacity to perform distant voyages, and were in the trade of Arabia, with the river Ganges, and countries beyond it. This work which, for approved accuracy of geographical, nautical and commercial information, stands unrivalled by any production of antiquity, comprehends under the name of the Erythræan Sea, all the ocean between Africa and

*The PERIPLUS (circumnavigation) was written about the first century of the Christian era by an Egyptian Greek, an intelligent merchant and practical navigator upon the Erythræan Sea.

India, including the Bay of Bengal. It observes that the unexplored ocean extends to the southward until it joins the Atlantic, information generally concealed from the age of Necos, B. C. 616, until the re-discovery of the Cape of Good Hope by the Portuguese in the fifteenth century.

Some authors say that Solomon's ships circumnavigated Africa and returned by the Mediterranean laden with gold. More likely they availed of the monsoons and went to Ceylon, India and Sumatra.

The Seres, described as the most remote people of Asia known even by report to the Europeans, are said to have manufactured sericum or silk garments from threads finer than those of the spider, which they combed from (cocoons like) flowers. Nearchus, the admiral of Alexander's fleet, speaks of this precious manufacture which found its way to Rome in the days of Cæsar, and being a monopoly and subject to a long succession of tedious and dangerous sea and land carriages, sold at a price making it equal in value to gold. Seres also shipped to Arabia steel much superior to all other kinds, the product of a country in the eastern part of Asia. White rock candy and porcelain such as is produced in China, was also shipped, and all these bore the expense of a succession of land and water carriages. May not the steel have come from Japan and the porcelain from China? When the Portuguese arrived on the coast of Asia in their first voyages of discovery, they found it frequented by vessels of various nations.

The natives of India, deriving all the necessities and enjoyments of life from their fertile soil and own industry, cared very little for productions of the West. Grecian merchants were obliged to pay for their cargoes chiefly in money, and Pliny says, that at the lowest computation, 500 sestertia (equal to £403,645 16s 8d sterling) was every year sent out of the Roman empire for the purchase of goods, which were sold in Rome at an advance of one hundred for one. A sum equally large was also paid to Arabian merchants for articles from their country of mere luxury and female vanity.

The increasing demand of almost the entire Roman empire for Oriental luxuries, all of which when crossing Egypt in transitu paid especially heavy import and export duties, increased the revenue of that country immensely; some idea of which is given us by Appian, who says Ptolemy Philadelphus at his death, left in his treasury 740,000 talents, (equal to £191,167,666 13s 4d sterling), much of which, however, may have been derived from the plunder looted by his father from the Persian empire.

In thus glancing at the early records of ocean navigation among the Arabians, Phœnicians, Greeks, Hebrews, etc., we discover the important position occupied by the Phœnicians, as the principal supporters of an early and extended intercourse with the Orient. We may draw some analogies therefrom in a future outline of the early commerce of Asiatic nations, among themselves, and their intercourse with the American continent in very early times. All these movements of peoples have an important ethnological bearing, as revealing the possible methods of migrations along the shore-lines of countries.

From early maritime records here cited in illustration, we are led to infer that intercommunication by water, along coast-lines, was very ancient among all western nations at a very early period, and we are persuaded that all

commerce was then in connected circles, like links of a chain; each orbit of trading fleets communicating at its extremes with others farther east and west. Thus the silk of China and Japan, unknown in Europe, found its way into ports on the Baltic Sea, through several limited districts of trade, each keeping within its natural limits, but acting as a medium for circulating the products of one extreme to the other. All trade being more or less a monopoly, the point of production of many valuable commodities was frequently concealed.

Certain terminal points exist in all trade where one system of commerce links into and connects with another reaching beyond. Such were Gadir, Massilia, Alexandria, Tyre, Sidon, Taprobanè (Ceylon), Molucca, Seres, etc.

Thus legends and traditions of far distant countries were communicated in advance of their discovery, and although at first deemed mythical, were generally founded on facts, and largely confirmed by later discoveries and explorations in the field, and since found fully detailed in Oriental histories yet extant. Every variety of enormity has in all ages been the characteristic ascribed by ignorance to unknown nations, and these have been gradually removed farther and farther as discovery advanced.

Great numbers of people were distributed by this early commercial enterprise, and how large indeed must have been the number of ancient Phœnician and Malay wrecks, if the Japanese wrecks of the present day may be accepted as any criterion. Nature is universally consistent.

In future papers I shall discuss the different origin of the Chinese and Japanese races, and conclude by expressing the opinion that early races have been far more spread and intermixed by early maritime intercourse, than the casual observer would suppose, and that, however distinct any type of mankind may appear, all will be found to be more or less composite, excepting, perhaps, some remnant of early aborigines, driven into a forced seclusion among the fastnesses of interior mountain ranges.

The authorities adduced in this paper might be greatly increased, but I have studied to be as brief as possible, aiming only to show the progressive quality and universality of natural law, whereby analogical reasoning is rendered comparatively safe, and to *establish the fact of early intercourse* among maritime nations of the West, rather than to fully illustrate either, by elaborate details.

Dr. Brigham read an invitation to attend the International Congress of Americanists, to be held at Nancy, France, July 22, 1875.

Judge Hastings called the attention of the Academy to the fact that the work of the State Geological Survey on the "Botany of California" would shortly be published. As the flora of the Pacific Coast develops some characteristic species, novel and interesting, worthy the attention of the students of this science, it is highly to be desired that the work on the botany of this State should be published. This publication is now secured

through the exertions of D. C. Gilman, President of the University of California, at whose request the following named gentlemen have contributed the necessary funds to put the work in stereotype: Leland Stanford, Henry Pierce, R. B. Woodward, Lloyd Tevis, D. O. Mills, J. C. Flood, John O. Earl, Wm. Norris and Chas. McLaughlin. These gentlemen are not known to be scientists, and do not appear to be actuated by any special or personal motive. The California Academy of Sciences, therefore, in recognition of their generosity, orders that their names be enrolled upon the records of the Society as benefactors of Science.

And it is deemed proper that honorable mention should be made of Professor Asa Gray, Professor J. D. Whitney, Professor Watson and Professor W. H. Brewer, for their personal devotion to the work without pecuniary consideration.

The Secretary was ordered to incorporate the above remarks in the minutes.

Regular Meeting, April 5th, 1875.

Vice-President Edwards in the chair.

Sixty-five members present.

Donations to the Cabinet: From Chas. D. Gibbes, bird's nests from San Joaquin County; from Mr. Frink, collection of grasses, bark and nuts from Hawaiian Islands; from Professor George Davidson, a collection of Japanese plants.

Horatio Stone read a paper on the Unity of Arts.

Amos Bowman read a paper on Coal Deposits of the Pacific Coast.

Professor Brewer exhibited a map showing the distribution of woodlands in the United States. In speaking of the map he alluded to the theory of the connection of the existence of forests with rainfall. In the investigations of the Smithsonian Institution, no instrumental evidence had been found, in any part of the United States, that the destruction of forests had re-

duced the rainfall. The fact appears to be so, but has not been properly proven.

Dr. Gibbons did not agree with Professor Brewer, and thought there was evidence to prove that there was a connection between the existence or non-existence of forests and rainfall. In California, in regions very limited in extent, the rainfall varies greatly in a few miles, the greater amount falling in the vicinity of timber.

Dr. Gibbons exhibited a branch of poplar tree on which a piece of misletoe had grown in a peculiar manner. It came out from the end of the broken branch as if it had been grafted.

REGULAR MEETING, APRIL 19TH, 1875.

In the absence of the President and Vice-Presidents, John Hewston, Jr., was called to the Chair.

Fifty members present.

The following new members were elected: Alfred E. Regensberger, Jas. B. Clifford, E. T Tarbox, Arthur C. Taylor, Chas. Frances, J. R. Stanton and F. P. Hartney.

Messrs. S. B. Christy and Frank Soulé were proposed for membership.

Donations to the Museum: From Professor Gustaf Eisen, University of Upsala, Sweden, two specimens of *Pinus flexilis* in foliage, two cones and foliage of the sub-alpine form from Mono Pass, former 12,000 feet, latter lower; also *Ephedra antisyphalitica* and *Abies Pattoniana* (Williamsonii) from same locality. W. G. Blunt donated silky poppies of an unknown plant used in stuffing birds; Joseph H. Clarke, of Cahto, Mendocino County, California, presented specimens of salmon trout. From T. J. Butler, Arizona, specimen of curious insect captured in Agua Fria River, Arizona.

Professor W. H. Brewer read the following:

On the Formation of Ice-pellets or Hail, in the Spray of Yosemite Fall.

BY PROFESSOR W. H. BREWER.

On Wednesday last, April 19th, in company with Mr. Galen Clark (under the Commissioners, custodian of Yosemite Valley), I visited the foot of the upper Yosemite Fall. In the winter, a great *ice-cone* forms in front of this fall, mostly, it is probable, an accumulation of frozen spray. It is now much reduced by thawing from what it was a month ago. At our visit, it extended below the fall several hundred feet, bridging the chasm to an unknown thickness. The two persons most familiar with it, respectively estimated its thickness that day at "sixty to one hundred feet," and "nearer two hundred feet." The outer side of this "cone" slopes away from the fall; the inner side rises like a wall in front of the sheet, which falls mostly behind it with deep, thunderous sound; the water flows beneath the mass, and emerges from an icy arch at its foot, which arch in shape and appearance strongly reminds one of the ice-arch in the foot of the glacier at the source of the Arveiron, at Mt. Blanc.

The stream was so high from the melting of the snow, that it dropped from the extreme top, not clinging to the rounded crest, as it does when the water is lower, but leaping out so that the actual leap is perhaps fully 1550 feet to the rocky bottom, and to the top of the "ice-cone," nearly or quite 1500 feet. Over the ice-cone the spray is furiously driven by the powerful air-blast produced by the fall.

The day was warm and clear, the time of observation between 12 M. and 12.30 P.M., and the fall in its brightest illumination, as it faces nearly south. As we neared the ice-cone, certain appearances suggested to me that the spray which drifted over it was (in part, at least) snow. To examine this, we ventured on this cone farther than strict prudence dictated, and in the tempest, which stung our hands and faces like shot, we found the spray in part to be *hail*, or *ice-pellets*. The exact character of these pellets could not be studied in the blinding blast to which we were subjected. They appeared to be hard, like hail-stones, tolerably uniform in size, and I estimated them at about one-tenth of an inch in diameter. They accumulated quite copiously on our clothes, but most so towards our feet, as if they were most abundantly hurled along near the ice on which we stood. They also accumulated in thin sheets on the rocks which rose through the ice near its edge.

The ice-cone, which had been very white during the winter, had been sullied by sand and dirt carried over it with the spray in the heavy storm of the previous week. Near its lower edge, however, were many depressions filled with what appeared to be new and pure snow, which we believed to be in reality fresh accumulations of these ice-pellets, but from their position it was impossible to examine them. We however pushed our way back to the rocky

wall beside the fall and as near the sheet as it was possible to breathe or to stand. If any of the pellets occurred there, I could not prove it. I could not feel them, and the water so blinded us that nothing could be seen distinctly. On returning, we kept on the rocks, and noticed none of the ice-pellets there. I had left my thermometer behind, and had no means of testing the temperature of this freezing blast.

At Leidig's Hotel, which is one and three-eighths mile distant and about a thousand feet lower, my thermometer stood at about 52° Fahr. at 6 A.M.; 78½° at 2.30 P.M.; 79° at 3.15. P.M.; 58° at 9 P.M., and 50° at 6 the next morning. I had no *wet-bulb* to determine the dryness, but that the air was very dry was shown by the rapidity with which our saturated clothes dried.

When this fall was visited by the State Geological Survey in June, 1863, the idea was suggested that we examine the temperature of the water above and below the fall, to see if any actual heating of the water occurred as a result of its concussion after falling from so vast a height. The dryness of the air was then so great that I was convinced that evaporation would counterbalance or at least vitiate any results that might be theoretically based on the mechanical equivalent of heat, so the experiment (which would have cost much labor and time) was not tried. And on seeing this new phenomenon, the hypothesis which immediately suggested itself to me as an explanation was that it was due to evaporation. That the fall is fed by melting snow, much of which still lies near its top; that the great volume of ice-cold water chills the adjacent air to near 32 degrees; that the air-current thus cooled, as it is drawn into and along with the immense descending mass, is a very *dry* current, and that its rapid saturation by this evaporation of a portion of the spray is sufficiently chilling to freeze drops of water up to a certain diameter. Had the ice-pellets been portions of the ice-cone torn off from its edge and hurled outward with its spray, we would not expect such an uniformity of size as I observed.

Professor John LeConte, on my describing the phenomenon to him to-day, has suggested another hypothesis, more plausible, perhaps, than mine. It is that the air carried down and cooled by the water is somewhat condensed at the base of the fall, and that by its expansion as it gets away from the pressure, sufficient cold is produced to freeze the drops.

Whatever may be the explanation, of the *fact* there is no mistake.

T. J. Lowry read the following paper:

Hydrographic Surveying.

BY T. J. LOWRY, U. S. COAST SURVEY.

Hydrographic surveys of bays, lakes, rivers, gulfs and the parts of oceans adjacent to coasts, are indispensable requisites to a safe navigation, and hence successful international commerce. Being of national importance, they are therefore national undertakings—and the Government Coast Surveys and

navies of all countries are engaged in determining and mapping the topography of the water basins and channels of the earth.

An accurate survey of waters adjacent to land is based upon a survey of the adjoining lands, by means of which the figure of the coast and the positions of a sufficient number of conspicuous and well-defined objects near the coast have been ascertained. These objects are the landmarks, by observations of which the positions of points on the surface of the water (and hence the soundings) are determined. The relative positions of the landmarks are ascertained with a degree of accuracy proportionate to the character and extent of information to be given by the chart. When perfect accuracy is aimed at, many stations on shore (and especially on island shoals and reefs) are first determined usually by a trigonometrical survey whose accuracy is tested by a base of verification. The stations in the triangulation being selected with reference to the ultimate ends in view (viz., the wants of the hydrographer and navigator), will be so chosen as to include or determine light-houses, headlands, and other remarkable objects—not allowing the triangles, however, to depart too much from the well conditioned forms. In making choice of stations, and thus giving shapes to the triangles, it is well to remember, that where *all the angles are to be observed*, the condition most favorable to the accuracy of computation—i. e., where instrumental errors and errors of observation will least affect the determination—is where each triangle is equilateral. But where *two angles only are to be observed*, the unobserved angle should be a right angle, and the observed angles equal to each other and never less than twenty-five or thirty degrees. Experience proves that, in well conditioned triangles, the small errors made in the measurement of the angles do not accumulate through each successive step in the operation, but on the whole tend to compensate each other.

Whatever extent of coast may be surveyed, each series of hydrographic operations will be confined to comparatively limited spaces, and the whole will consist of numerous detailed charts correctly linked together and harmonized by means of the triangulation on shore; a description, therefore, of the *modus operandi* in making a hydrographic survey of a single harbor or short sea reach will apply equally to the system adopted in the survey of an extensive line of coast.

Having made a reconnaissance of the region to be surveyed, and gathered a general idea of the facilities for, as well as the difficulties of doing the work, the next step is to locate tide gauges and tide observers.

Judging from all information that can be gathered of the prevailing winds, currents, tides, shoals, and the configuration of the shore line, the hydrographer will fix the number and sites of his tide gauges so as to get data for determining the figure of the surface of the water at any given instant. They should be more numerous the more the surface of the water at any instant deviates from the horizontal form. And the fewer the gauges used the greater the care to be exercised in deciding upon their locations. Placing a gauge within a bar, sand-bank or other impediment to the free action of the water, or within a lagoon which winds fill with water faster than it can escape, is to be especially guarded against. And in comparatively limited basins of water

at least two gauges should be established—one at that side of the basin nearest "whence the prevailing winds come," and the other nearest "whither they go." These gauges are not only checks on each other when the wind's action is an insignificant element, but where the wind drives water from one portion of the basin and piles it up in another, they furnish data indispensable for harmonizing soundings taken on those and calmer days.

In such a basin, when but one gauge is used, the proper place for it, theorectically speaking, is the center of the basin. These considerations attended to, each gauge is firmly fixed in a well sheltered spot, so that its zero shall be below low-water at neap, and its top above high-water at spring-tides. By proper circumspection for the site of each gauge, one will generally be found to answer for each station, but where the observation is made from shore two or more may at times become necessary—the observer following the tide from gauge to gauge as it goes out and retreating over the same path as it comes in. The kinds of tide gauges are as various as the circumstances demanding them. The one ordinarily used is of the simplest kind, a straight vertical post divided into feet and tenths, numbered from the bottom upwards; this is found generally to serve its purpose, inasmuch as when it is too windy to read the gauge correctly, it is blowing too much to sound accurately. A vertical tube with small holes at the bottom to admit the water which supports a float, is, however, susceptible of closer readings under all circumstances; and for getting off-shore tides, Mitchell's gauge is admirably adapted; while as a self-registering gauge, Saxton's stands without a parallel and leaves nothing to be desired.

The zero of each gauge should be referred by means of a spirit-level, or otherwise, to a bench mark cut distinctly and durably on some permanent object (and the remark made in the book), so that, if displaced, it can be properly replaced in position.

For the purpose of reducing the soundings, it is mainly essential that the tide-gauge and sounding-boat watches be together; but where the laws of the tides of the locality are also desired, it is best to keep either lunar or mean solar time. A series of observations of the tides on these gauges, made simultaneously with the soundings, furnish data for reducing each sounding to the reference plane—the mean of the lowest *low* waters. This plane is also given by these tidal observations. The frequency of the necessary readings of the gauge varies from every half-hour to every five minutes, according to the rapidity of the rise and fall of the tide.

And now, if there be not on the shore permanent well defined objects that will serve as signals—such as spires, towers, flagstaffs, light-houses, or tall slender trees, fixed by triangulation—then the hydrographer erects the necessary signals; usually tripods boarded up, and painted white if projected on dark back-ground from the sounding-boat, or red (or black) if against the sky or a sandy back-ground.

The tide-gauges and signals being erected, the next step is to determine carefully with a theodolite the relative position of these signals, and plot them by the computed sides of the triangles of which they are the vertices. It is, however, not imperative that the actual sizes of the triangles be at first

known; but the triangles can be computed and plotted from any assumed base, since the "relative positions of the signals" is the essential desideratum.

Hydrographic surveys all have for their main object the tracing, determining, and plotting, on a suitable scale, the contour lines of navigable channels and water-basins. Contouring represents the inequalities of the earth's surface by determining the relative heights of any number of points above or below a line equidistant at every point from the earth's center. This line is what is understood by the term "a level-line," and is that which is assumed by the surface of the water when at rest. In mapping the contours of parts of the earth not covered with water, after the principal contour lines are drawn on the topographical sheet, intermediate lines may, with the ground before the eye, be sketched in; but such interpolations are obviously impossible when tracing the contour lines of a basin filled with water, as in hydrography, where a series of points in the curves of equal depths are brought out only by lines of levels made with the sounding-line. Now, since these lines of equal depths are analogous to contour lines on land—being contour-lines of the bottom of the water-basin, drawn through those points where the reduced soundings are equal—the same rule hence obtains in hydrography as in topography for the directions of the lines of levels for developing them—viz., perpendicular and parallel to the strike or dip of the bottom, i. e., one system of sounding-lines coincident with, and another at right angles to the lines of the steepest declivity of the bottom. The lines run in the general directions of the curves of equal depths, or horizontal curves, are the main lines in developing the contours of the bottom; yet the auxiliary lines which should be run perpendicular to these not only check these depths, but also furnish additional data for drawing these curves of equal depths. At a crossing of these lines the difference of the soundings should not be more than three per cent., and the limit of error must not exceed five per cent. of the depth.

To form some idea of the general configuration of the bottom of a body of water, we must call in every available aid; as, the topography and geology of the adjacent coast, the effects of currents, tides, and prevailing winds, and, most of all, the revelations of our lead-line, which assist us in judging of the topography of the parts yet unsounded, and hence better fix upon the directions of the lines to be run. The force and directions of winds and currents and qualities of the vessel must of course be considered in laying out directions of sounding-lines. And the greater discretion exercised in giving directions to these lines the fewer in number will it require to bring out the bottom's varied features in the length and breadth of their modulation. The number of lines required depends upon the extent of the information to be furnished by the chart.

If for purposes of general navigation, the soundings on the map will be sufficiently numerous when the horizontal curves (viz., fathom and half fathom, up to three fathoms, and inside of that, feet curves) can be drawn without doubt as to their directions in any case. As to the frequency of the casts, where the bottom is very irregular, are wanted not casts at studiedly regular intervals, but every possible sounding.

Whether it is the demands of the navigator or the marine engineer that are being satisfied, along with these contour lines of the bottom are required the materials of which the bottom consists, the level, rise and fall of the water, the directions and speeds of its currents, and at times, the temperatures and specific gravities of the water. The accuracy of the methods and instruments for executing these surveys also varies with the amount of detailed information required. If the survey be made for the erection of a breakwater, instead of purposes of general navigation, then are desired nicer instruments for observations, more well-determined signals, more cast positions determined, more soundings on a line and more lines of soundings, more specimens of bottom and more current observations. In every case, however, the whole ground should be gone over thoroughly to bring out the general features of the bottom and detect each sudden irregularity of depth, which should be traced through its every line of approach, and if it proves to be an isolated knoll or ridge, it may be "rayed off" by planting one or more temporary buoys on it, and to and from them running radii in different directions. However, as these radial lines are often insufficient to bring out its every feature, others may be run at right angles to them. Yet for general purposes of navigation the general features and extent of a reef and the shoalest cast on it are found amply sufficient. As each sounding is taken, the surveyor notes its depth and also the time which fixes its position with reference to other points on the line determined by either sextant, theodolite or compass angles on known fixed points.

The degree of precision with which the positions of the sounding-boat are fixed determines the accuracy, and hence usefulness, of a hydrographic survey. To fix the position of the sounding-boat, under every variety of circumstances, is, therefore, the all-important problem in practical hydrography, and the method most universally relied upon by the hydrographer for determining his boat's position, is that by the three-point problem.

This problem is wide in its application, accurate in its determinations, and most simple in its graphic solutions. The simultaneous observation of the two angles subtended by three signals fix the place of observation under every possible contingency—except when it is on the circle passing through these three signals—i. e., when the three circles of position are coincident. The accuracy of the determination of positions by this problem depends mainly upon the relative positions of the signals and the observer, and the size of the observed angles—being the very best where the signals are equidistant from the observer, and subtending angles of 120 degrees. The three signals in a straight line, is a favorite location with many hydrographers, as it offers but one case of indetermination, and that very easily avoided, of being on the straight line passing through them. But in general a most desirable location is where the circle through the three signals is convex towards the observer, and the middle one is the nearest of the signals, for then "a revolver" is impossible. Other things being equal, it is better to "angle on" the more distant objects which subtend good-sized angles—say from 45 to 135 degrees—for not only is the parallax of the sextant then less, but an error

made in getting an exact coincidence of the images of the signals is then less felt by the angles than if the signals were near or the angles very acute.

And besides what is thus told by the relative positions of the signals, the hydrographer should be able to read the tale which the size of the observed angles tell of a position's fixedness. If the sum of the observed angles equals 180 degrees or more, then the observer is sure he is not on the circle of indetermination. But if this sum is less than 180 degrees, and equal, or nearly so, to the supplement of the angle subtended at the middle signal by the other two, then the position is not determined. By having these supplements written about the signals, between the proper lines, on the field-sheet, we can by a mental summing of the observed angles tell (without plotting) whether we are too near the circle to get a good determination; and may thus catch other angles that better fix our position.

The three-point problem finds in the three-arm circular protractor an accurate, simple and most expeditious graphic solution, which is most extensively used in plotting positions of the sounding-boat. In practice the observed angles are set off on the proper lines of the protractor, and the fiducial edges of its arms caused to traverse the three points representing the signals observed upon, and the center dotted, and the position is plotted. If breakers denoting danger be observed at a time when it is impossible to anchor over them, or even approach them to fix a buoy to mark their locality, their position may be marked quite accurately by pulling around them and getting cross ranges (or cross magnetic bearings) of prominent objects on shore, so disposed as to guide the observer to the spot in more favorable weather, when a perfect calm may leave no trace whereby the danger can be recognized.

Henry Edwards submitted the following:

Pacific Coast Lepidoptera, No. 11.—List of the Sphingidæ of California and Adjacent Districts, with Descriptions of New Species.

BY HENRY EDWARDS.

As the value of local lists is fully recognized by entomologists, I propose, in the present paper, to furnish a complete catalogue of the species of this interesting group of Lepidoptera, as far as known to me to inhabit the Pacific Coast, and to offer descriptions of what appear to me to be forms as yet unrecognized by science. The number of species, compared with those of the Eastern States, is but small, but extended exploration of our little known mountains and valleys may furnish us with others, while it is more than probable that many of those from Northern Mexico may yet be found within our borders; and, acting upon this belief, I have introduced the description of an exquisite species from the region of the Sierra Madre, which may some day have to be included in our lists. I have followed the arrangement proposed by Messrs. Grote and Robinson in their catalogue of Lepidoptera, (No. 1, Am. Entom. Soc., 1868,) and have invariably adopted the generic

terms of those authors. The notices of the habits and localities of the species are from my own observation, and for them I am personally responsible.

Tribe MACROGLOSSINI.

Arctonotus lucidus. Bdv.

Head, palpi, antennæ, thorax, and abdomen, yellowish olive. Thorax, with the tegulæ a little darker, and edged narrowly with white. Abdomen, with small anal tuft. Anterior wings, yellowish olive, with a darker median band, not reaching the interior margin, and surrounded by an oblique rich purple border along the interior margin, and obsolete before reaching the costa. This border has a rather brilliant metallic reflection. Beyond the middle is a notched shade of olive, resting on the costa, a small linear patch near the apex, and a lunate streak near the interior angle, of the same color. Fringe of the exterior margin, yellowish, with the edges brown; that of the internal margin, purplish, concolorous with the oblique band. Posterior wings, reddish fawn color at the base, with a rich claret-red submarginal band, narrowing inwardly, and lost in the brown hairs of the anal angle. Margin, broadly reddish fawn color, the same shade as the base of the wings. Under side, grayish olive, with a ferruginous patch on disc of the anterior wings. Fringes, deep fawn color. Middle tibiæ, with four black, shining, palmated spines, recalling somewhat the structure of the fore tarsi of *Gryllotalpa*. Hind pair, with two spines, fawn color, clothed with hair.

Expanse of wings, 2.00 inch.

Length of body, 1.00 inch.

Coll. Dr. Behr, Sacramento. H. E., Oregon.

I have taken the liberty to redescribe this very rare Sphinx, as Dr. Boisduval's description is both brief and vague, and as I have had the good fortune, recently, to examine six specimens of this little known insect, which were forwarded to me from the Dalles, Oregon, for the most part in excellent condition. At present, this is certainly one of the rarest species known to American entomologists. I have followed Mr. Grote in placing this genus in the present group, though not without misgivings, as its general structure, particularly the form of its antennæ, its long body clothing, and its extremely short tongue, seem, as Clemens observes, to point out its proximity to the *Bombycidæ*. It has been placed by this author, and by Walker, at the extreme end of the *Sphingidæ*.

Hemaris Thetis. Bdv.

Through the kindness of my friend, Mr. Grote, I have recently had the opportunity of examining Boisduval's type specimens of this species, the former gentleman's admirable description (Trans. Am. Ent. Soc., Vol. 1, 1868) rendering further notice of it unnecessary. I should, however, observe, that in fresh specimens there is always present on the hind tibiæ a bunch of long, pale yellow hairs, which are not visible in the somewhat worn and faded type specimens. The presence of the reddish apical spot in the anterior wings is, I think, by no means a safe character, as in any one of my specimens it is

quite apparent, while in two others it is entirely absent. This species may, however, be always known by the thoracic and abdominal clothing, which is invariably dull olivaceous, with a brownish tinge, and is extended without any break to the yellow pre-anal segments. *H. Thetis* is found in the valleys of California, chiefly in the neighborhood of the Coast Range, and may be sought for, in May and June, in Napa, Sonoma, and Marin Counties. It is especially attached to the flowers of various species of *Lupinus*.

Coll. H. E., (exactly agreeing with Boisduval's type) Dr. Behr, *et al.*

Hemaris rubens, n. sp. (?) Hy. Edw.

Under this name, if a true species, I wish to recognize two specimens, in my collection, in which the apical red mark is very distinct above and below, the oblique scale patch at the base of the primaries reddish, and the costa and margins of the wings on the lower side also with a decided reddish hue. In *H. Thetis*, the two pre-anal segments alone are yellowish, but in the two specimens referred to above, the yellow is carried on to the third segment, dorsally and beneath, but is interrupted on the sides by a black band. This appears to me to be a strong character, as in my examples of *Thetis* the yellow shade is distinctly confined to the two pre-anal segments. Slightly smaller than *Thetis*. The tuft of yellow hairs on the hind tibiæ is present in this species.

Oregon, Lord Walsingham. Lake Tahoe, Cal., Mrs. Hy. Edwards. Coll. H. E.

Hemaris cynoglossum, n. sp. Hy. Edw.

Size of *H. Thetis*. Head above, pale yellowish olive; eyes, margined behind with white scales. Palpi, pale yellowish, with the terminal joint tipped with black. Thorax above, bright greenish olive, without the brown tint observable in *Thetis*. Basal segments of abdomen, rich velvety black. Two pre-anal segments, pale yellowish, with a darker median shade. The under side of abdomen, including the anal tuft, is wholly black, except the edges of the pre-anal segments, which are pale lemon yellow. The thorax is less covered beneath with yellowish hairs than in *Thetis*, and the pale scales are hardly visible at the base of the wings, while the tufts of yellow hairs on the tibiæ, so eminently characteristic of *Thetis*, are here wholly wanting. The wings above and below are similar to the allied species, but are decidedly more opalescent, giving out a most beautiful bluish reflection. Antennæ, blue black. The fore wings are a little sharper at the apex than those of *Thetis*.

Two ♂, two ♀, Coll. Hy. Edw., taken by myself on flowers of *Cynoglossum grande*, Dougl.; Napa County; Big Trees, Calaveras County, Cal.; Vancouver Island.

The species of the genus *Hemaris* are very closely allied, and can be separated only by characters which in other genera would hardly be deemed sufficient to indicate a difference of species. I think, however, that the absence of colored hairs on the basal segments of the abdomen, and of the pencils of yellow hairs on the hind tibiæ, will serve as good grounds for

separating this form from its allies. The differences between them are very apparent in a series of each.

Hemaris palpalis. Grote.

Taken at Gilroy, Santa Clara County, by the late G. R. Crotch. Its chief difference from *Thetis* seems to be in the darker shade of the labial palpi.

It is somewhat remarkable that no species of Mr. Grote's genus *Hæmorrhagia* has yet been discovered on the Pacific Coast, more especially as in the Atlantic States the species are more numerous than those of *Hemaris*.

Ællopos tantalus. Hubner.

This fine insect is not rare in the neighborhood of Mazatlan and other portions of Northern Mexico, and I have seen a specimen taken at Cape St. Lucas, Lower California. It may, therefore, yet be found within our limits.

Euproserpinus Phaeton. G. & R.
=*Macroglossa Erato.* Bois.

This exquisite little species, so rare at present in collections, appears to be found only in the vicinity of Los Angeles, two specimens in the collection of Dr. Behr and the original types in that of Dr. Boisduval having been obtained from that locality. It is said to be an early insect, and probably disappears with the flowers of the spring.

Proserpinus Clarkiæ. Bois.

As the delicate green tint of this beautiful insect fades very quickly, I subjoin the following description from a very fresh specimen, taken during the past summer, in which the original color is at present admirably preserved. It will be seen that both Clemens' and Boisduval's descriptions give a wrong idea of the color of the insect.

Head, greenish olive above, whitish beneath; labial palpi, whitish, with green tinge. Eyes and tongue, brownish black. Antennæ, black above, reddish beneath; terminal spinule, white, with the extreme hook yellowish brown. Thorax above, greenish olive, whiter at the sides and beneath. Abdomen, greenish olive with a white tinge, except the three anal and the fifth segments, which are dark olive green, the anal segment being marked in the center with a paler streak. Beneath, the abdomen is greenish olive, with the segments edged posteriorly with white. Anterior wings, rich greenish olive, the color of *P. Ænotheræ*, paler at their base, except towards the costa, where there is a darker shade. "The median space is rich greenish olive, narrowing to the internal margin, and enclosing a black discal streak." Behind this band, and resting on the internal margin, is a pinkish shade, not visible in old specimens, and beyond this is a rich olivaceous band, spreading to and widening out upon the costa, the outer edge being somewhat notched. Fringe of the anterior wings, olive green, tipped with black Posterior wings, bright orange yellow, with a broad and moderately regular black marginal band. Fringes, yellowish white. Under side of wings, wholly olivaceous green, darkest at the base. Across the disc of the posteriors is a slightly waved

whitish band. The discal streak of the anteriors is scarcely visible. Feet and legs, whitish green.

Not rare in the northern portion of California and southern Oregon. A number of specimens were taken by Lord Walsingham, near Fort Klamath, and it occurs not unfrequently, in May and June, throughout the Coast Range and the Sierra Nevada. It appears to delight in the flowers of the various species of *Gilia*. Dr. Boisduval says that his specimen was raised from the caterpillar by the late Mr. Lorquin. It is a matter of regret that we possess no record of its earlier stages.

This is undoubtedly the species referred to by Mr. Grote in Bull. Buffalo N. H. Soc., 1874, as *Lepisesia Victoriæ*, the description having been evidently drawn up from a somewhat faded specimen.

Proserpinus Terlooii, n. sp. Hy. Edwards.

Head and palpi, yellowish olive. Eyes, black. Antennæ, dark olive; pectinations, brown; hooked tip, white. Thorax and abdomen, yellowish olive, the former with some darker shading in front. Anterior wings, yellow olive, greener towards their outer margins, with a median band of olive green, widest on the costa, and a triangular patch, a little paler than the band, resting on the costa near the apex. Fringe, mottled with brown. Posterior wings, dull claret red, paler along the costa, and shading into deep rich brown on the posterior margin.

Under side. Anterior wings, yellow olive, with a wide central shade of dull red, reaching from the base to within three lines of the margin, but not touching the costa. Posterior wings, yellow olive, with indistinct waved median band of a little darker color.

Expanse of wings, 1.65 inch.

Length of body, 0.70 inch.

Two ♂ Coll. Dr. Behr, taken near Mazatlan, Mexico, by the late Baron Terloo, to whom, at Dr. Behr's request, I dedicate this interesting species.

Tribe CHÆROCAMPINI.

Chærocampa procne. Clemens.

I can learn nothing whatever of this insect, and think some error must have occurred as to its locality. Is it known that the type specimen is in existence, and, if so, where?

Deilephila chamænerii. Harris.

This species, which I am disposed to regard as different from *Galii* of Europe, is not uncommon in Vancouver Island, and has been occasionally taken in Oregon and Northern California. It would satisfy many entomologists if a long series of this insect could be raised from the caterpillar, through a succession of years, as by these means alone can we arrive at a certain conclusion as to its value as a species. It seems to me to be a much heavier and more clumsy-looking insect than *Galii*, and its general color is considerably

darker. But it appears somewhat absurd to claim for this the rank of a species, and deny the same position to its congener, which follows, as between *Daucus* and *Livornica* more really serious differences exist than between *Chamænerii* and *Galii*.

Deilephila Daucus. Cramer.

This is perhaps the most common of all the *Sphingidæ* of the Pacific Coast, being found from May to August in almost every garden, hovering about flowers, especially those of *Verbena*. The caterpillar, though well known, has never, to my belief, been described or figured. It feeds on various species of *Rumex*, *Epilobium* and *Polygonum*. The additional white stripes upon the thorax certainly give this a wide separation from *Livornica* of Europe, while there is considerable difference in the shape of the median oblique band of the anterior wings. In a specimen of *Livornica* from Italy, and also in one from the White Nile (both in my collection), this line is broader than in the American specimens, and, as it reaches the internal margin, spreads inwardly further towards the base of the wing. The costal markings also are more decided in the European and African specimens, and the marginal band of the posterior wings is certainly much narrower.

Philampelus Linnei. G. & R.

A fine specimen of this very handsome species exists in Dr. Behr's collection. It was taken by the late Baron Terloo in the northern part of Sonora, Mexico, at the base of the Sierra Madre.

Philampelus Achemon. Harris.

Very common, in some seasons, in the valleys of Napa and Sonoma Counties, where the caterpillar is exceedingly injurious to the vines. In the summer of 1874, at St. Helena, Napa County, over ten bushels of caterpillars were gathered from one vineyard, only four acres in extent, in the course of two days. I can perceive no difference whatever between the California specimens and those from the Eastern States.

Tribe SMERINTHINI.

Smerinthus ophthalmicus. Bdv.

Formerly rather common in the vicinity of San Francisco, but owing to the drainage of large districts, and the consequent destruction of the willows on which the caterpillars fed, it has become quite a rare species. In the foothills of the Sierras and the Coast Range, as well as in Oregon and Vancouver Island, it is occasionally met with, and a strongly marked variety is also found, which I have called

Smerinthus pallidulus, var. Hy. Edw.

It differs from the typical form by its much paler color, as well as by the almost obsolete markings of the upper wings. The general color of these is a

pale fawn drab, with the waved band indistinct. The thorax is also much paler, and the median patch of this portion much narrower and less defined.

Mr. Strecker's figure of the ♀ in Lepid. Rhop. et Heter. refers to this variety.

Smerinthus modestus. Harris.

Another very remarkable instance of departure from the specific type is found in our examples of this species, all of which are very large in size, the smallest I have seen being upwards of five inches in the expanse of wing, the specimens from the Atlantic States rarely measuring as much as four inches. There is also a remarkable difference in color, the western specimens being much paler, the basal space within the median band being, for the most part, of a delicate silver gray, which color is also extended to the thorax and abdomen. The white discal streak is also more strongly defined, and the suffused reddish patch of the lower wings usually much larger. Knowing nothing of the caterpillar, I am unable to say if any difference exists between it and its eastern relative, but it is possible that in this instance we have to deal with a new species. I prefer, however, at present to regard it only as a variety, suggesting for it the name of

Smerinthus occidentalis, var. Hy. Edw.

Fort Yuma, Ariz. San Diego. Sacramento, Cal. Carson City, Nevada. Dalles, Oregon.

Coll. H. E.

Tribe SPHINGINI.

Macrosila carolina. Clem.

As far as I am able to discover, this species was unknown in California until the introduction of tobacco planting, a few years ago. It is now very common in some portions of the State, particularly in the San Joaquin and Santa Clara valleys, and promises to be as great a pest to the growers of tobacco as it has proved in other parts of the continent.

Macrosila celeus. Hbn.

Rather rare at present, though it has been taken near San Diego, and in Mendocino and Napa counties. The caterpillar feeds upon the potato, and it is probable that, like the preceding species, this may be an introduction from the Atlantic coast.

Macrosila cingulata. Fab.

I have seen only two Pacific coast specimens of this insect, one from San Diego, the other from Santa Barbara. It is very abundant in the Hawaiian Islands, where the caterpillar feeds on the sweet potato (*Batatas edulis*).

Sphinx oreodaphne. Hy. Edw. (Proc. Cal. Acad. Sci., July, 1873.)

My friend Mr. H. Strecker, of Reading, Pa., has suggested to me that this may be only a small form of *Sph. chersis*, Hbn., and certainly there is a great resemblance, excepting in point of size, the largest specimen of *Oreodaphne* I have seen measuring only 3⅛ inches in expanse, the smallest 2¾ inches, while the average size of *Chersis* is 4⅛ inches. The markings, also, even in the most perfect specimens, are much less pronounced than those of *Chersis*, and the general color of the insect is much paler. If, however, Mr. Strecker's conjecture be correct, the synonymy will have to be
Sphinx chersis. Hbn.

Var. *Oreodaphne.* Hy. Edw.

Sphinx perelegans. Hy. Edw. (Proc. Cal. Acad. Sci., July, 1873.)

I am inclined to think that this and the following species are only two of others which will yet be found in California, having an affinity with *Sp. gordius* and *Sp. eremitus* of the Atlantic States. The only specimen of this species was taken by the late G. R. Crotch, at Gilroy, Santa Clara county, and is in my collection.

Sphinx Vancouverensis. Hy. Edw. (Proc. Cal. Acad. Sci., July, 1873.)

Since describing this species, I have had the good fortune to procure two other specimens, one from Portland, Oregon, and the other from the Big Trees of Calaveras county. They are so strongly marked as to put to flight any doubts I may have entertained as to the genuineness of the species.

Hyloicus Sequoiæ. Bdv.

I am only acquainted with one specimen of this very rare species, taken by myself in Bear Valley, Placer county, and noticed in Proc. Cal. Acad. Sci., July, 1873.

Hyloicus Strobi. Bdv.

Dr. Boisduval is himself in doubt as to the locality of this species, and without a careful examination of the type it is difficult to say whether it be Californian or not.

LIST OF SPECIES NOTICED IN THIS PAPER.

Arctonotus lucidus, Bdv.................................California, Oregon.
Hemaris Thetis, Bdv......................................California.
Hemaris rubens, Hy. Edw. n. sp........................California, Oregon.
Hemaris cynoglossum, Hy. Edw. n. sp. ....California, Vancouver Island.
Hemaris palpalis, Grote..California.
Ællopos tantalus, Hubn..Mazatlan, Mex.
Euproserpinus Phæton, G. & R..........................Los Angeles, Cal.
Proserpinus Clarkiæ, Bdv............California, Oregon, Vancouver Island.

Proserpinus Terlooii, Hy. Edw. n. sp. . . . . Mazatlan, Mex.
Chærocampa procne, Clem. . . . . Loc. dub.
Deilephila chamænerii, Harris. . . . . California, Oregon, Vancouver Island.
Deilephila daucus, Cram. . . . . Arizona, California, Nevada, Oregon, V. I.
Philampelus Linnei, G. & R. . . . . Mazatlan, Mex.
Philampelus Achemon, Harris. . . . . California, Oregon.
Smerinthus ophthalmicus, Bdv. . . . . California, Oregon, Vancouver Island.
Smerinthus ophthalmicus, n. var. *pallidulus*, Hy. Edw . . . . California.
Smerinthus occidentalis, n. sp. (?), Hy. Edw. . Cal., Nevada, Oregon, Arizona.
Macrosila carolina, Clem. . . . . California generally.
Macrosila celeus, Hbn. . . . . California.
Macrosila cingulata, Fab. . . . . San Diego and Santa Barbara, Cal.
Sphinx oreodaphne, Hy. Edw. . . . . California, Oregon.
Sphinx perelegans, Hy. Edw. . . . . Gilroy, Cal.
Sphinx Vancouverensis, Hy. Edw. . . . . . California, Oregon, Vancouver Island.
Hyloicus Sequoiæ, Bdv. . . . . Sierra Nevada, Cal.
Hyloicus Strobi, Bdv. . . . . Loc. dub.

Col. Geo. E. Gray offered the following resolutions, which were adopted:

WHEREAS, The California Academy of Sciences has learned of the resignation of Professor Daniel C. Gilman of the Presidency of the University of California, and of his contemplated removal to Maryland; and

WHEREAS, The important services rendered by Professor Gilman, to the University and the cause of higher education, in California, are known and appreciated by this Academy. Therefore, be it

Resolved, That the California Academy of Sciences expresses to Professor Gilman its appreciation and approval of the work he has here accomplished, its confidence in his ability, and its testimony to the energy and devotion which he has exhibited in the performance of his duties as President of the University of California; that we thank him for the services he has rendered to the cause of higher education, here and elsewhere; that we regard his removal, so far as it affects this community, with regret, tempered by the conviction that in the new field of labor upon which he is about to enter, his varied acquirements, combined with many fortunate personal qualities, will prove fruitful in benefits to the entire country; that he will carry with him our respect as a fellow-worker, and our esteem as a fellow-member and a man.

Resolved, That the Secretary is hereby instructed to transmit a copy of the foregoing to Professor Gilman, and to the Trustees of the Johns Hopkins University at Baltimore.

Regular Meeting, May 2, 1875.

President and Vice-Presidents being absent, Dr. H. W. Harkness was called to the Chair.

Sixty-two members present.

Charles Wolcott Brooks read the following paper:

Origin and Exclusive Development of the Chinese Race —Inquiry into the Evidence of their American Origin, suggesting a great Antiquity of the Human Races on the American Continent.

BY CHARLES WOLCOTT BROOKS.

In searching for the origin of any race, the careful student is led to the barrier of pre-historic ages, where, amid the scanty remnants of remote antiquity, he seeks the missing links of a chain whose farther end has passed from the vision of general observers.

All ethnologists must recognize the importance of reviewing the early stages of religious belief current among any people, and laws governing its development, in any systematic study of their earliest origin.

Every act of man and every change in nature is self-recording, and although it may require the wisdom of a God to read the record, it yet exists, capable of being deciphered, and contributing to history.

With the advance of scientific knowledge, the human line of division between so-called historic and pre-historic ages is gradually receding. Science and historical criticism are opening many fields long hid in myth and conjecture. Much now classed as ancient mythology is but the lingering remnants of very ancient history, preserved and distorted by tradition. Most ancient nations in their written histories, have aimed as far as possible to ignore all antecedent civilizations, claiming for their own deified ancestry the origin of all men. Barbaric conquerors, filled with the spirit of battle, were early deified as gods, their descendants accepted as demi-gods were founders of reigning dynasties, and naturally sought protection by surrounding their origin with the supernatural. Transformations are frequent in the mythology of all nations, for religion, in whatever stage of its development, ever remains a grand, progressive, moral science. Many ancient forms of pagan worship glided silently into even Christian rites, when martyrs canonized as saints, noiselessly replaced the divinities of former systems.

As most early gods were ancient heroes deified, their worship was a nat-

ural manifestation of a low order of patriotism, which selfishly detested all nations but one chosen people. Each nation seems to have created its own god in the image of its highest ideal. Early ideas of God have been successively adjusted to the intellectual capacity of each progressive age, whose highest ideal has ever been the natural limit to its powers of mental or spiritual conception, possible under existing conditions of development.

Modern science and its civilizing arts have refined our personal conceptions and raised our ideal, by extending our limits of comprehension. Our own conceptions of the Great Architect, the Intelligent Mind of the Universe, as they exist to-day, are as much nobler than those of the ancients, as the magnificent enginery of this nineteeenth century excels the rude implements of early ages.

Notwithstanding this tendency to ignore antecedent civilizations, the most ancient peoples of antiquity, at the period of their very earliest records, show plainly that civilized life existed before their time.

In speaking of civilization at early periods, it is evident we cannot mean that of the printing press, telegraph and steam, as known in the nineteenth century, for no record of any such exists, but reference is made to a high state of early culture among cities of solid structure, with foreign commerce and mechanic arts, in contradistinction to barbaric, nomadic, or pastoral conditions.

Great maritime empires existed in very remote periods; and both Alantic and Pacific Oceans were crossed, and races and civilization widely extended in ages still called pre-historic. Whether we study the historical records of Arabian, Phœnician, Chaldean, Assyrian, Egyptian, Persian, Central Asian, Malay, Chinese, Japanese, Central American or Peruvian nations, we are amazed at the antiquity to which they lead us. Many oriental records now in process of translation, throw much light on the early movements of races. Asia in the far East was long considered the land of enchantment—a name given by superstition to early science. Astronomy was cultivated in Persia B. C. 3209; in India, B. C. 3101; in China, B. C. 2952; and in Egypt, B. C. 2800. Truly, wise men came from far east of Greece and Rome.

In Egypt, India, China, America and South Pacific Islands, evidences of a primitive civilization are found, which, in some instances, must have run its course long anterior to the age of Homer. Unmistakable traces of a primeval and ante-historic culture of the human race in America exist to mark the lapse of many ages of civilized existence. A knowledge of the western shores of the American continent has long existence in both China and Japan. That a restricted communication has existed by sea across the Pacific does not admit of question. When treating of the origin of the Japanese races several historical instances of their early trans-Pacific voyages will be described and discussed.

In comparatively modern times, enthusiastic specialists, versed in Hebrew traditions, have sought to locate the primeval source of all knowledge and culture upon the high table lands of Asia, where they pictured the radiant morning of civilization as immediately succeeding the completion of a cre-

ated world, perfected in all its parts, including man, the most complex being and climax of creation.

In a search after the origin of any race, we are first led to define a belief in the origin of man. I accept the hypothesis of universal evolution by a slow process of cosmic development, from matter which includes within itself the elements of all atmospheric, mineral, vegetable and animal existence, but latent until its energies are quickened by that progressive life-principle which ceaselessly radiates from the Great Intelligent Mind of the Universe, and is everywhere essential to awaken development.

This hypothesis, clearly within the scope of human thought, is able to stand the test of human reason, and now seems tangibly demonstrated, especially in the connected chain of fossils recently discovered and arranged by Professor Marsh, which visibly illustrate, by an incontrovertible record of natural history, the evolution of the *eques* or horse family, anchitherium, hipparion, etc.

All material things appear connected together by gradational forms, from the superior mental culture of man, the highest animal, to the protozean or lowest speck of gelatinous matter in which life manifests itself to human perception, onward through untold ages of mineral existence and cosmic conditions, ever in exact keeping with its pace of progress. All things that develop have life. Earth has labored to fit itself for the abode of man, and its labors are progressing successfully. Man came by regular stages of gradation from the monad, and his mental development keeps pace with and is restrained by physical surroundings. Immutable natural laws, universally and eternally in force, do not admit of any sudden, special creation of man, nor do they indicate that all forms of animal life could have been created at the same time. What has once occurred will, under similar conditions, occur elsewhere.

Man is the result of all inferior types, whose capabilities are within himself, making him a compendium of all created things. Fossil remains, found in different formations, are plainly revealing the stages of progressive transformation, each successive one having all the attributes of its predecessor, with more added. Crustaceous animals are succeeded by fishes, running into the saurian, thence into birds, next marsupials, followed by the mammalial, up to man. Animal development has unfolded, and is continually improving as the physical conditions of the globe are improved and refined, and higher conditions rendered possible.

Mind is an attribute of matter, each being instrumental and necessary to develop the other. Goethe says: "Mind cannot exist without matter, nor active matter without mind."

The man of cultivated mind has reached more than a mere physical being, having developed within himself a portion of that superior intelligence, the germ of which he inherits from the Mind of the Universe. The human mind is unmistakably progressive, and progression is an eternal principle. Hence, mind, the highest refinement of matter in man, is eternal. Our greatest revelation from the Infinite is in His works, where nature matures a supply for every want she creates. The power to conceive of immortality

therefore implies ability to attain it. This glorious truth is instinctively felt and recognized by every branch of the human race.

The origin of man has been gradually, yet hastily, traced as the result of a constantly progressive life-principle, awakening development in matter, successively evolving from cosmic conditions, minerals, plants, and all the lower forms of animal life, up to its climax, intelligent humanity. In man is to be found the highest physical ultimate of matter, endowed with that further refinement, a moral and progressive spirit, capable of ultimately unfolding his full physical and mental capacities. In human evolution, we can but outline the origin of existing physical forms, which periodically change with constantly modifying conditions. The immortal quickening principle which we inherit, can only be traced to the Infinite.

The animating principle of all existences, appears like a purer and more highly refined essence or form of electric force; equally manifest in mental and physical development, and exactly adjusted in all its different degrees to successive stages of progressive refinement. Natural law is universal. In the material process of electrotyping, man follows Nature's own method of building up metallic forms. The progressive life-principle of the human mind, in common with endless varieties of electric phenomena, manifests universal consistency in the positive and negative phases of a subtle activity. Some correlation with a Central Intelligence seems reasonably indicated, whence these mutually radiate as developing powers; alike in kind, varying only in degree, of force, purity and refinement.

It appears probable that the ancestors of the earlier types of mankind, were evolved, by gradual development, near the oldest parts of continents, along their central summits, upon such portions as first acquired a soil after emerging from a hot primeval sea. Primitive man, at first a speechless animal, may have appeared as a distinct variety of the animal kingdom, in the case of a single pair, from which all human races have multiplied, and differentiated according to the surrounding conditions of their local abode. If so, the physical conditions of certain localities have been far more favorable to the advancement of certain races than others, and early human history must be by *race* and not by *nations*, as communities of individuals come but with the first steps to culture.

Within the limits of races best known, languages and families of languages are found, which preclude any common linguistic origin. It therefore follows, that if man constitutes but a single family in the order of Primates, represented by a single *genus*, the formation of language must have commenced after the still speechless primordial man had diverged into races, and differentiation had set in. With the development of ideas in the mind, however rude at first, and organs capable of articulation in the body, language was a consequent result, under the operation of universal law. The Great Intelligent Principle of the Universe pervades the entire world, as our mind fills our whole physical frame. The manifestation of this principle we call Life, which all things possess in greater or less degree.

Development is ever progressive, although mutability appears to mark every advance, yet no breach of continuity has occurred. Every order has proceeded by natural process from another antecedent. The superimposed

strata which constitute the crust of the earth, form a gauge of relative time, for which human-chronology scarcely affords a unit of measure. It is perfectly certain that during the cretaceous epoch, a comparatively recent period in the world's history, none of the physical features existed, which mark the the present surface of the globe. Continents have undergone movements of elevation and depression, their shore lines sunk under the ocean, and sea-beaches have been transferred far into the interior of pre-existing continents. All dry land has been submerged, excepting recent volcanic products and metamorphosed rocks. These introductory facts are necessary to ethnological research.

A cooling sphere, having acquired a solid crust around a nucleus of fiery liquid, in parting with its heat by radiation into space, must contract, distorting its outward surface by pressure, raising mountain ridges, and depressing corresponding valleys, where the first seas became located. Sun and moon, obedient to the law that bodies move to each other in proportion to their masses, and inversely as the squares of their distances, attracted tidal movements in molten fluids under the crust, in hot salt seas, and the thick unrefined atmosphere above. Fluids as well as other matter were more gross during their primitive states. Rupture and re-formation succeeded one another, until the primitive igneous period of angular azoic granite, became sufficiently hardened to withstand the ordinary pressure of inward forces, gradually preparing to furnish physical conditions, suitable to begin the evolution of animal life in its most elementary forms, corresponding with the imperfect condition of existing elements.

During the mighty struggles of the unrefined elements, internal convulsions sent the hot salt sea surging over a large portion of the surface, and sedimentary deposits formed new stratifications. Substances impregnating the waters united in forming crystals. The waters, having raged from point to point, were obliged to seek an equilibrium, and retired to the valleys, forming various oceans, seas, lakes, and rivers.

In the early carboniferous period which succeeded, the extra nitrogen and carbon were rapidly absorbed from the air, and the density of all exterior elements greatly reduced. A period was thus established, where, under favorable auspices, and in limited localities, the very imperfect initiatorial orders of vegetable and animal life appeared. An infinity of embryo existences are contained within the crust of the earth, awaiting the slow process of development. Life generated at the initial period was of the very lowest order, unable to support or reproduce itself to any considerable extent. From this threshold of progression, conditions became sufficiently advanced to admit of the systematic reproduction of species; the age of spontaneous generation having performed its limited duty in the general ripening of the globe, may have ceased and passed away with conditions which sustained it, and matter, within itself, matured the power to reproduce its kind, endowed with a progressive principle, destined eventually to evolve its ultimates. This hypothesis explains why spontaneous generation may have had its day and subsequently ceased.

Crinoides, *conchiferæ*, *crustacea*, *polypi*, and *polyparia* successively appear as elements are advanced to the necessary conditions to sustain such forms of

life. The systematic development of *flora* and *fauna*, in successive ages, extends in an orderly chain from their dim and distant beginning, to our own time, through universal changes of atmosphere, climate, and oscillations of temperature. A continual unbroken chain of organisms has extended from palæozoic formations to those of our day, governed by law that knows no change. Each species has gradually evolved from its predecessor in an antecedent age, by a gradual modification of its parts, culminating in the age it characterizes, and fades away in succeeding ones.

Change is everywhere the soul of nature. The race which first acquired the human form, and became properly entitled to be called Man, probably ascended from one original type, which has since diversified, and may in this age be divided into five distinct *varieties* (not types), generally classified as Caucasians—*white*, Mongolians—*yellow*, Malayans—*brown*, Americans—*red*, and Negroes—*black*.

As white and black are apparent opposites, and science shows the white race to be superiorly developed, it is fair to presume that primitive man was black; subsequent nations, brown; their branches, red; from these sprang the yellow, and thence the white. Under local changes of atmospherical and physical conditions, of climate, food, etc., the original black became modified to a permanent brown. In like manner one shade and color after another became permanently established. As with complexion, so also with stature, symmetry, and strength. Proper use develops, while disuse brings decay.

Some anatomists have claimed that color may be produced by the arrest of utero-gestation, or is governed by its relative duration in races, thus "causing the ultimate portions of the blood to become so assimilated with the cellular and serous tissues of the fœtus as to render the body variously colored—black, brown, red, or copper color." *Lusus naturæ* have illustrated this fact.

The present of any race depends largely upon the physical conditions of the soil they inhabit. When these remain unaltered, the race cannot advance, unless it can develop, by brain power, sufficient ingenuity to overcome the drawbacks to advancement; such as draining marshes, heating dwellings, importing ice, etc., thus growing, in spite of natural restraint, faster than the slow process of natural evolutionary changes would permit.

Modifications in different types of vegetable or animal life neither progress equally nor evenly. There is no intrinsic necessity that they should undergo modifications at all, unless conditions change, or in the case of man, who invents ways of surmounting natural conditions. To him the extreme North becomes habitable by the use of warm clothing, artificial heat and light during long winter nights. By a restless spirit pressing him forward and a judicious control of elements, he is enabled to obtain artificial conditions far in advance of the physical condition of his habitation, and thus pre-naturally exalt and develop himself and his race. With the loss of these conditions the highly developed man would perish or relapse into a comparatively barbaric state, to where his development would exactly agree with his actual physical surroundings.

Darwin unmistakably illustrates the tendency of all forms to variations, which when once produced, join in equal battle to survive and supplant their

progenitors and all others. The fittest will maintain itself and the others perish, the parent and derived forms being equally dependent upon their individual adaptability to surrounding conditions. Thus, certain localities still exist in the condition of ages long past, where inferior races yet flourish and find themselves better off, more competent to deal with difficulties in their way, than any variation derived from their type. While conditions continue unchanged they remain unsupplanted by other forms, and their type becomes very pronounced. Exact reproductions are rare. Amid infinite similitude there is infinite diversity; and imperfection is a vast fact, which must always be taken into account in all hypotheses. "Animal beauty arises from the perfect balance of physical parts and the rhythm and perfection of their action." It is probable that no perceptible change has taken place in the Chinese race for many years, because in that time the incomplete changes of physical condition in their country have not admitted of it. Wheat found in tombs with Egyptian mummies, when brought from darkness into sunlight and planted in congenial soil, grew and produced wonderfully, but could never have developed without a change of conditions. Change is imperative to progress.

A complete knowledge of embryology furnishes an unerring record of the origin and development of any form of animal life; for the embryo of higher types, while in process of maturing, pass successively through a recapitulation of all forms by which their species ascended by evolution to their present condition. Since conception, each human being has passed rapidly through modifications, the counterpart of the graduated forms through which his race has been slowly built up, and his present condition reached. Thus, we have a history of human evolution republished in every case of reproduction.

Man, as traced by his embryotic development, commenced, when in darkness, the cohesion of two or more gelatinous molecules, impelled by a constantly-progressive life-principle, united to form a microscopic zoösperm, capable of preserving its new condition in a thick and heated liquid. The proportionate duration of early life in warm water is revealed by the first nine months of his existence, during which many successive but correlated forms are assumed. Dr. Cohnstein, of Berlin, (quoted in the *Lancet*, May, 1875,) "has determined by means of the thermometer that the temperature proper to the *fœtus in utero* is higher than that of the mother." The hot salt sea in which early life developed, is here typified. The period of atmospheric air having arrived at birth, emerging into light, his aquatic life ends, and becomes terrestrial and aërial. New elements of food are supplied, and the mode of nutrition changed. For awhile his food continues liquid, and he sees, hears, and notices but little. By degrees he arrives at a consciousness of the solid world, first rolling, then creeping, seal-like on four limbs, then sits upon his haunches, and finally walks erect, at first tremblingly, then playfully, but firmly, at last. This reveals how nature required successive physical conditions, to acquire progressive results. Each being owes his present bodily form, to ascent through a parentage, each change of which has passed away, after accomplishing its intended purpose, a culmination reached by degrees, through countless generations of improvement.

In due time, children acquire teeth, and another change of food ensues,

and hair usually darkens. A second set of incisor and carnivorous teeth soon mark another stage of progress, and youth succeeds childhood, bringing an expanded development of bodily form, passions, and intellectual power. No individual can reproduce until he reaches the full maturity of the type to which he at present belongs, which prevents the race from receding, by reproducing a lower type. Leaves grow out or drop off, but never grow back. Nature never retrogrades; advance or perish is law to the individual.

Man can imitate any animal of his species, but no animal can follow man beyond its developed powers. Many traits, exemplified in lower animals, are successively developed in children, and overcome by proper control; such as gluttony, cunning, and deceit—the latter a lingering trait of weakness, general with inferior races. They repeat the antics of a very active and mischievous race; their first attempts at drawing, resemble the rude figures made by our primeval ancestry and present wild tribes; furthermore, like "children of the forest," our younger children have not reached the age of self-cleanliness.

The impulsive ferocity of youth, and cooler maturity of age, are but characteristic types of human transformation in the evolutionary procession. Our lives acquire a double significance, when we find we are building an inheritance for every one of our descendants, while our race continues.

In our growth, we *re*-evolve, concisely, the story of our race's lineage, as in "*the house that Jack built*," each succeeding verse comprehends all its predecessors. Our present bodies now barely float; for, as man acquired his upright stature, his frame must have increased in weight and hardened into greater rigidity; while the pelvis, to sustain additional weight thus put upon it, enlarged, thickened and increased his gravity.

The head of the human species seems originally to have been large in proportion to the body, exhibiting a promising germ thus early advanced, a fact to which the race may owe its present superiority; and, possibly, this early development of the organ capable of acquiring knowledge, may account for peculiar sufferings, visited upon woman, more particularly among the most intellectually developed.

The highest type of man has been artificially advanced beyond the condition of some portions of the physical world. Miasmatic swamps are yet insufficiently reclaimed by time, to permit a white man's existence where they continue. Their present condition would involve his speedy illness and dissolution. Lower organizations, congenial to and in harmony with such conditions of physical development, may exist and flourish there; but more refined types of humanity, require the most perfected physical conditions, for their perfect enjoyment and highest attainments.

Centripetal law has consolidated the Chinese into a positive and exclusive people, who delight in ignoring the centrifugal or complimentary force, which induces dispersions. They have long clung to unique customs and dress, resisting change or improvement. In their stereotyped form of frozen civilization, differentiation has been arrested, and a peculiar type itensified. Unalterable fixedness in forms of belief, and habits concreted by centuries, furnishes convincing evidence of great antiquity. The black races are ethnologically far less developed, and having no fixed belief to displace, are more readily converted to any religious sect.

We cannot avoid admitting that the Chinese are one of the oldest families of the ancient world; yet they are by no means the oldest. Until the seventh century before the Christian era, they were perfect strangers to every form of idolatry. Pure Chinese appear like a race absolutely distinct from nations by whom they are surrounded, differing in physical characteristics of form, color, and expression; in language, in their written characters, their literature, and religious observances. Unchanged by foreign conquests, by extensive intermixture with any foreign race, they have developed within themselves, preserving and perhaps intensifying their type; governed and civilized by the principles contained in their own classic literature, and in their pure and excellent book, the Chou-king, compiled fully 3,000 years ago, from their more ancient literature, much as many suppose Moses to have compiled the Pentateuch, or as Heroditus compiled early Grecian history.

China has her ancient picture writings, but no ancient idols. She has her literature older than the Sanscrit races. When the great pyramid of Menes was built, in the fourth dynasty of Egypt, B. C. 3893, we find one vast and expanded system of idolatry throughout Asia, and the countries bordering on the Mediterranean, all worshiping emblems, more or less types of the sun or solar principle, China standing alone—far back in the twilight of history—is a solitary exception on the continent of Asia.

Language is a test of social contact, not of race. Undoubtedly the first expression of human thoughts were by configurations of countenance, such as smiles and scowls, indicating pleasure, dread, or anger. With the invention of complicated forms in language, capable of complete expression without emotion, came deceit, frequently followed by loss of harmonious social relations, and developing combativeness. No primitive history, at present known, conveys any reliable account of an aboriginal language much anterior to that of China; although that of the ancient people of Yucatan and adjoining American nations, as shown by picture-writings on their monuments, appears to have been more ancient.

Both peoples, in common with the Egyptians, expressed thoughts by picture-writing and in hieroglyphics. While other surviving nations improved upon this original style, by developing the phonetic; inhabitants of China alone, became exclusively confirmed in their monosyllabic language, and their manner of vocal communication, is still very peculiar and spasmodic in sound and utterance. Their hieroglyphics, which, in early ages, expressed a single substantial thought, were subsequently assumed as syllabic representations, and became synthetic or compound forms of expression. Thus, to-day, 216 Chinese radicals are made use of, in over 50,000 ideographic combinations.

To investigate this subject, requires extensive research in a multitude of directions—physiological, linguistic, religious, traditional, geographical, and migratorial—for it is often by their mutual comparison only, that satisfactory results are reached. The wider view we can compass, the clearer our understanding of general laws. There is in force a law of decreasing vitality, as well as of evolution, both alike depending upon the refinement of surrounding conditions. Great disturbances have affected the earth's surface and all living things, since the tertiary period, when our present zoölogy fairly started

into being. To all these considerations, must be added the ancient migrations which the different families of mankind have passed through, under the changing conditions imposed upon them by geographical and climatic necessities, and thus a systematic arrangement of facts is finally indicated. Physical geography teaches us that of the two great elements, water and land, the latter, which is matter in a more advanced form, is far superior in the animal and vegetable life to which it gives origin; likewise, that low and swampy land is fatal to health and the highest development of man. Geology and Palæontology show this to have been equally true of the *flora* and *fauna*, in ancient days.

Neither tropical Africa nor Asia are adapted to the Anglo-Saxon constitution; every white colony there has been wasted by sickness and death; yet this is the native and natural climate of the dark races, who are there as much at home as is the polar bear on the shores of Greenland. When at Saigon, on the Meikong river, I was told by an officer of the French colony, that 24 per cent. of French troops stationed there died annually. The British occupation of low lands in the southern portion of India, is scarcely more than a military possession, so far as Europeans are concerned, who cannot long live there, but would soon become extinct but for the constant influx of fresh immigration. There, a European struggles for existence, a prey to fever and dysentery, and is unequal to severe labor. White women, as a rule, are especial sufferers, rallying but poorly from any illness. White men must yield the tropics to the dark races. The reverse is also true; negroes are not comfortable in the frigid zone. The American residents of New England States, as at present constituted, have a continual fight with existing conditions of climate, and their survivors and descendents, now in process of acclimatization as a race, are assuming a somewhat typical form.

Whenever we examine nature, we find a perfect adaptation of animals to the circumstances under which they live. The constitutional temperaments of the different races seem to vary. The dark races are less developed than the white; they have a less nervous sensibility, for their physical organization is less delicate. Van Amridge says: "The dark races expire less carbonic acid from their lungs than the white, but transpire the fœtid matter chiefly by the skin." According to Dr. Knox, the nerves of their limbs are one-third less than the Saxon of equal height. Great differences of shape in the pelvis of different races, have been classified by Doctors Vrolik and Weber, who thus report the four principal races: "The European is oval; the American, round; the Mongolian, square; and African, oblong."

The characteristics most relied on for the discrimination of races, are the color of the skin, structure of the hair, and conformation of the skull and skeleton. Transitions from one to the other are so gradual, that it seems almost impossible to draw any exact and arbitrary line of inter-demarkation. We now see the various branches of mankind confined to distinct localities, mainly bounded by isothermal lines, with distinction of form and color, with different social relations, religions, governments, habits, and intellectual powers. Wherever men have migrated, they appear to have found and displaced an aboriginal nation, and no record is believed to exist of any people ever migrating to a land which they found entirely destitute of inhabitants,

in some of the various stages of human development. Adelung reckons the total population of the earth as 1,288 millions, professing 1,100 forms of religion, among which there exists 3,664 known languages or dialects, viz.: 937 Asiatic, 587 European, 276 African, 1,624 American. These are significant facts.

Sir Charles Lyell is inclined to admit that an imperfect form of man was living when the tertiary stata was deposited. Agassiz, who pronounced America the oldest continent extant, measured the coral growth during a given number of years along the southern half of Florida, which, he asserts, has been formed by accretion during the geological period known as recent, and must have required not less than 135,000 years to form. We may arrange epochs in their order of sequence, but not of date, for in contemplating the vastness of such a past, the mind becomes lost in amazement at the vista opened into antiquity. The histories of China contain records of the past, which modern chronologies have insufficient room to measure. The limits of history are steadily receding, and Greece and Rome are taking their proper positions in a comparatively modern era. Science is developing unanswerable proofs of the greater antiquity of the human race, than current ecclesiastical histories have been supposed to allow. Greater freedom in chronology is absolutely necessary. No sound religious principles have aught to fear from true interpreters of antiquity. Truth, in all its natural simplicity, is susceptible of proof, and reason is its steadfast supporter. Nature's own religion is grander than any human conception. In the dark ages, mysteries, miracles, and absolute imposture stood in the way of absolute truth. Evolution gives to the Infinite higher attributes, and more nearly connects him with all created things. The God of the true scientist is grander and more comprehensible to mankind. It takes us half our lives to unlearn and eradicate errors honestly taught us in youth, with perfect good faith and intention, which persistently cling to us until displaced by the sound reasoning powers of maturer years. Each conscience is but the result of its own moral education. It is composed of ideas it has fed on. Many imbibe, hereditarily, the opinions of their forefathers, and venerate them because they were first upon their mind, which circumstance alone produces to them an unsophisticated conviction of their truthfulness. None are free but those whom Truth makes free:

> "Most men by education are misled,
> They so believe because they so are bred;
> The priest continues what the nurse began,
> And so the child imposes on the man."

America was undoubtedly peopled many ages before Julius Cæsar landed in barbaric Britain, and many of the colossal structures, whose ruins still excite the wonder of the wandering Indians of Central America and Peru, doubtless passed from use long before the Tartar conquerors in Central Asia drove their hordes eastward, or Attila and his Huns swept his legions westward, from the great wall of China and the steppes of Ancient Tartary.

Chinese historians assert that in the fifth year of the reign of Yao, B. C. 2,353, strangers from the south, of the family of Yoüe-Tchang, brought, as a

present from a maritime kingdom in southern seas, a great turtle, three feet long by three feet wide, and very old, on whose back was written a history of the world, from its commencement to that time, which Yao ordered transcribed and preserved. Turtles have long had a peculiar religious significance in Japan, and also among American aborigines at Copan, where a splendid stone altar of great antiquity, in the image of a similar tortoise, yet remains.

Chinese culture, dwelling apart in the south-eastern extremity of Asia, has developed and retained distinctive national types, coldly conservative, while nations less peculiar, and perhaps more adventurous, rose, scattered, and passed away almost by scores. The isolation of their peculiar civilization must have resulted from the physical conformation of the spot they occupied, encircled by protecting ranges of mountains, and forbidding natural barriers.

Eminent Chinese historians, after describing the fabulous and mythical ages, which are imperfect and idealized recollections of events, peoples, eras, and civilizations; and renowned individuals whose exact history had become confused, extinct or legendary, when their first authentic records of ancient history were penned; come to the reign of men. Greek history appears limited when looking beyond into Oriental records, and proves but a scanty stream leading to a broad ocean beyond.

The deified rulers are naturally the most ancient, and are succeeded by demi-god descendents, in a sort of middle age. The advent of conquering heroes from a foreign soil, by introducing a new element into history, may have changed the national era. A careful study of the various ancient histories of the world has led me to infer, that, generally, rulers who are said to have descended from the gods, were merely successful invaders of the country where they died, and were there canonized or deified. Being born in a foreign land, no local record existed of their parentage, and it was easy to ascribe their origin to supernatural causes, while their death being among the people whose traditions have come down to us, was witnessed and recorded.

All scholars experience difficulty in tracing up and locating ancient places, as most of them were given new and foreign names, by conquerors and explorers. Since the days of Tyre and Sidon, and the ancient and long continued sway of the South Arabians declined, and gave way to the rise of great monarchies in Western Asia and India, places have received new rulers and taken new names. This is true throughout history, of all countries, and is more recently illustrated to us, in the saintly names given by Spanish and Portuguese explorers; or head-lands and islands re-named for British seamen and their patrons. A less troublesome impediment to accurate identification, is found in translated names.

The progress of science, and linguistic and historic researches, continually supplements our knowledge of the mighty past, whose history must now be worked back by degrees, and every fact capable of yielding testimony, preserved and utilized. Chinese records, extending to B. C. 3,588, may yet render valuable aid in perpetuating much that was destroyed in the lost libraries of Phœnicia, Chaldea, and Egypt. The first era of Chinese history is without dates, capable of being accurately fixed by any measure known to us

at the present time. So of Methuselah's age. We cannot believe that the duration of human life changed suddenly from hundreds of years to three score years and ten. The change, if at all, was in the human measure. During our present century, the average longevity of Great Britain has increased nearly ten years. The true "*elixir of life*" is a scientific knowledge of the limits of our being, and wisdom to use our powers so as to obtain their utmost capabilities. Wisdom is the best use of knowledge.

This early Chinese era consisted of three dynasties, who, successively with their descendents, ruled the kingdom of China, whose dominion had not then spread into an empire, and the aggregate terms of their reigns must have extended over a long period of time. This period may represent the rule of early Asiatic aborigines, developed upon the soil of China.

Chinese historians commence their second and more authentic era with the reign of a sovereign named Tai Ko Fokee, or Great King Stranger. He commenced his reign B. C. 3,588, and from this founder of their line of monarchs, they have preserved a national history and true chronological succession of their rulers. His name seems to imply that he was a foreign conqueror, who occupied the country, and doubtless, at the time of his conquest, took no pains to preserve the records of superseded dynasties, which come to us only in the form of tradition.

The pictorial representations of King Fokee which have come down to us, represent him with two small horns, similar to those associated with the representations of Moses, the Hebrew law-giver. He and his successor are said to have introduced into China the hieroglyphic characters for picture writing, somewhat similar to those found in Central America, and from whence the ideograms now in use are conceded to have been derived. He taught his people the motion of heavenly bodies, the twelve celestial signs, and divided their time into years and months, besides bringing them a knowledge of many other useful arts and sciences. The sudden advent of so much new knowledge, brought by one man, indicates that he came from far away—from a country with which no previous communication had existed. As he introduced a new measure of time, we can but estimate the duration of eleven reigns which preceded him.

Probably the solar day was the earliest measure of time; then, the lunar month; and lastly, the solar year. The various words used in all languages, and interpreted to us years, meant, simply, the *periods of time* which at the moment constituted its measure. Thus, if Methuselah lived 969 periods of time when the lunar month was the accepted measure, he died at 74¼ years of age, which is not improbable.

The great Chinese history of Tse-ma Chi-ang, written B. C. 122, and purporting to be an accurate transcript of all earlier existing histories, which it was desirable to consolidate and preserve; narrates events, chronologically, from the reign of Hoang-Ti, which commenced B. C. 2,697, when he was eleven years old; during his minority the kingdom was governed by wise and prudent counselors, who, it says, took great care of the young monarch, and educated him in all the useful arts and sciences then known. It is recorded that during his reign physicians first learned to feel the pulse; the magnetic needle was first used, pointing to the south; and civilization greatly

advanced. He lived a useful life, was greatly respected, and died at a ripe old age. During a portion of his reign, a powerful revolt was successfully put down, indicating a mixed race, with the antagonisms of conflicting opinions. Five of his descendents succeeded, in turn, to his throne. Then came *Tai Yao*, followed by *Yuti Tsi Yune*, B. C. 2,294, during whose reign a great deluge occurred in Asia, which flooded fifteen provinces of China and drowned great numbers of inhabitants. Some portions of the country remained under water for several years thereafter.

This rupture of a natural barrier, which held in check some extensive inland basin of water, existing at a higher level, occurred just fifty-four years after Archbishop Usher fixes the arch-catastrophe of Hebrew tradition, and was doubtless like the Noachian flood, a crisis in the physical history of the region where it occurred. It is highly probable that the great interior alkaline deserts of North America, where the successive water lines around the surfaces of every elevation of its various levels, clearly indicate the former presence of vast inland basins of water; have at some remote period been, in like manner, drawn off and precipitated upon lower levels of this continent, in their journey towards the common level of the ocean. This is also shown by the presence of ancient river beds across the present summits of the Sierra Nevada Mountains. Nothing seems to impede the execution of unerring physical laws, and in the consideration of general history, natural science shows no relation between such physical calamities and personal guilt.

B. C. 2,233, the next Emperor, *Ta Yu*, caused canals to be cut, to convey to the sea the immense bodies of water which, during the reign of his predecessor, had been precipitated upon and overflowed so large a part of China. By this means many deep river beds were finally cut, and continued to be worn away by the receding waters, until the whole country was freed from inundation.

His eleventh descendent and successor was a tyrant, and was banished in the fifty-second year of his age, and king *Ching Tang* came to the throne, B. C. 1,766, and died 1,753 B. C. During his reign a great famine existed in China, which the records say lasted seven years. Joseph's famine in Egypt occurred B. C. 1,707, or forty-six years after this date. These coincidences are merely cited as suggestive to historical students.

It is desirable that the historical records of all ancient nations should be sought out and compared; and to our linguistic and archæological students on the Pacific, the early histories of China and Japan should be made the subject of careful study. Much mental and social cultivation existed in Asia when Europe was yet in her dark and undeveloped ages. China and Japan, as well as all the nations of Asia, yet contain many ancient records, that may well repay careful study, revealing traces of a civilization whose history is incredibly remote. Ere the ancient respect for sacred records has become impaired, and they are cast aside or destroyed in the ecstasy of a new-found religion, or the mechanical wonders of a scientific civilization, earnest and reliable students may acquire much important testimony among the archives of India, China and Japan. Few ancient races have preserved a literature of equal value with the Chinese. The great past of prehistoric humanity bears traces of activity and commercial intercourse throughout Asia.

About five thousand years before the Christian era, the Sanskrit branch of the Aryan race invaded and occupied Northern India, while the Arabian Cushites, dwelling in Arabia, held control of Southern Arabia. These South Arabians held innumerable colonies, and were unrivaled in power and commercial dominion. They early established great influence as a maritime people along the coast of South-western Asia, colonizing much of the Asiatic seaboard in the deepest antiquity,—not, however, including the present Chinese territory, but exercised a widespread influence from the extremes of India, even to Norway, acting an important part as pioneers in spreading and developing early civilization. The nomadic tribes of Asia have been classed as of Semetic origin.

China, although well known, and mentioned in the ancient Sanskrit writings, under the name of *Yama*, was never included in statements of the migrations of races and peoples throughout Western Asia, Hindostan, and the islands of the Indian Sea. In remote antiquity, the Chinese nation appears to have lived within itself, cut off from active communication with any neighboring people.

According to Arabian traditions, *Ad* was the primeval father of the pure Arabians, and built a city in Arabia which became great and powerful. The Adites are referred to in the earliest dawn of Arabian history, as enterprising, rich and powerful, having great cities of wonderful magnificence. They were skillful builders, rich in gold, silver, and precious stones, showing them acquainted with metals. Numerous appliances of our civilization had their origin far back in the obscurity of ages now pre-historic, and Adam may be but the Hebrew tradition of the ancient Adites of Arabia, who must themselves have had a long line of ancestry, to have developed and acquired such civilization. Adam was, perhaps, simply the ideal embodiment of a *beginning of humanity*, typified to the Hebrews by an Adite patriarch, beyond the experience of their own history, into which he was adopted by Moses, *as the ancestor of their race*. It was an effort to extend their national lineage far back to an original First Cause. The distinctive Hebrew race descended from Abraham, that magnificent sheik, the mighty Mesopotanian prince; Israel's ancestral hero and first distinctive Hebrew personality; great grandsire of the princely Joseph, Lord Chancellor of Egypt, Prime Minister of the first Sesostris, and monotheistic chief of an illustrious line. Thus he stands, in bold relief, on the canvas of tradition, as a great leader of human kind in the period comprised in the first essays of Hebrew literature.

Our opinion of the general inaccessibility of China from other parts of the continent of Asia, in early times, is confirmed by a passage in the history of Besorus, relating the conquests of the Arabian sovereign, *Schamar Iarasch, Abou Karib*, who reigned over Chaldea, and 245 years before the rise of the Assyrian empire carried his arms, B. C. 1,518, into Central Asia, occupied Sarmacand, and for a long time attempted, without success, the invasion of China. Humboldt describes an Himyatic inscription existing at Sarmacand in the 14th century, in characters expressing, "*In the name of God, Schamar Iarasch has erected this edifice to the sun, his Lord.*" All facts go to show that migrations over Central Asia, from Arabia across the continent, must have passed north of China, (which country seems to have maintained

her individuality nearly intact), and reached the shores of the Pacific near the peninsula of Corea, which is still inhabited by a populous nation, quite unlike the Chinese race. Many aborigines of Central Asia were doubtless driven toward the coast by these Arabian conquerors. These South Arabians were a people older than the Aryans. The great ages of Cushite civilization, to which we are told they succeeded, closed at a period which was very ancient when the book of Job, the oldest book of the Hebrew scriptures, was penned as a Persian poem.

Testimony is universal that the oldest nations succeeded older pre-existing peoples, and generally received their highest ideas from abroad, showing a descent of ideas as well as of blood. A constant admixture of races, peoples and nations has been successively going on for ages. It is only in some secluded spot that we may, at this late day, discover traces of anything approaching to an early type, with slight recent admixture. Such specimens, if they exist at all, cannot but be extremely rare, and, like the Miauts of China and some remnants in the Tyrolese Alps, inhabit regions virtually inaccessible.

The huge stone structures, cities and temples being unearthed in Yucatan, argue an enormous early population. The ruins of Copan, and disintegrating pyramids of Palenque, are convincing proof of a great pre-historic race in Central America, at an immensely early period; which must have occupied the same relative positions toward North and South America that Asia Minor did, in remote ages, to Central Asia and Africa. The peculiar construction of all the arches found among the buried cities of Yucatan may lead to the discovery of races cognate to its early inhabitants. The same principle of arch was used in very early times by Egyptians, Greeks, and Etrurians.

Notwithstanding the frequent disastrous fires, and destruction of records by conquerors and founders of dynasties, who have annihilated much valuable material, China, Japan, and the interior of India have many copies and manuscript translations of very ancient works and histories, long retained among their sacred treasuries, rich archæological prizes for modern explorers to unearth, equal in interest to the lost history of Iran, mentioned in the Dabistan and other Asiatic writings.

By an extended research into ancient histories, many plausible reasons are found, which argue the possibility, and almost probability, that some early aborigines of the pure Chinese race may have crossed by sea from the coast of Peru to China in an early or remote age of the world. Recent travelers in Peru inform us, that its aboriginal races have, like our North American Indians, become nearly extinct; and the only remaining traces are found among the China-chola, a mixed result from Spanish and Portuguese ancestors. Last year my attention was called to an article in a South American paper, describing the remnant of a race of aboriginal Mongolians or Chinese, found among the high table lands upon the western slope of the Andes.

Phœnicians and Egyptians, who each received hieroglyphical characters from a common source, originating in an older people, ascribe them to Taut. The Chinese ascribe them to Tai Ko Fokee, their Great Stranger King, who reigned B. C. 3588. Many curious coincidences point to the supposition that

he may have brought them from Peru or Central America, where, among ruins still existing, there has been discovered much early picture-writing, closely corresponding to early Chinese characters, comprising the 216 radical ideographs now used. Thus, heaven is expressed by three horizontal lines, slightly curved; and earth by a cross within a circle. In discoveries at Copan is a figure strikingly resembling the Chinese symbol of Fokee, both nations representing him like Moses, as a lawgiver, with two small horns. Many figures on Peruvian water-vessels, of great antiquity, are identical with those found in Egyptian temples; birds' heads, for example, attached to figures resembling a comma, but intended to represent tongues; and other remarkable coincidences. Either one people learned from the other, or both acquired these forms from a common source. Many physico-geographical facts favor the hypothesis, that it is more rational to conclude that Egypt received them from America, through China—possibly through Fokee, or some predecessor in very remote ages. Recent scientific explorations are reported to have exhumed Chinese sacred mottoes, carved on tombs in Egypt—counterparts of phrases in use to-day—revealing the existence of an intercourse when China was ruled by kings anterior to Moses.

The present written language of China is undoubtedly an imported method, advanced from such picture-writings as those of the ancient Peruvians, or primitive hieroglyphical signs of ancient Egypt. Among some nations, mental progress evolved a simple alphabet, while others remained content with the increasing complications of ideographic signs, for syllables and objects. Egypt, like China, was tenacious of her individual peculiarities, and long retained her hieroglyphic type. She finally abandoned it, while China clung to but improved it.

The South Arabians and their descendants, the Phœnicians, having an extended commerce established throughout the Indian Ocean, with every known shore, undoubtedly passed more readily into a simple phonetic alphabet, better adapted to the practical wants of a commercial people. Tablets have been discovered among their ancient ruins, by which the various changes are readily traced.

Chinese characters, so long surrounded by the ultra conservatism of an impenetrable isolation, have undoubtedly developed from these common forms of natural objects, and subsequently been adapted to easy and rapid writing, with a peculiar style of brush, and their manner of holding it.

The consideration of whether the Chinese people originally developed in Asia or abroad, bears an important relation to the origin of the Japanese race, the subject we are ultimately investigating and shall consider in our next paper. In seeking the initial points whence migrations have diverged, we naturally gather all possibilities, whence we select probabilities, in the hope of finally eliciting absolute truth. We shall be compelled to limit this already lengthy paper to setting forth certain fundamental principles useful in research; and to a collection of evidence, the full discussion of which will necessarily remain for a future occasion.

Without, in any manner, endorsing the following hypothesis, we shall simply aim to shadow forth a few *possibilities*, which the consideration of many curious facts have suggested during the laborious details of an elaborate search.

How came the Chinese—a people so ancient, so reserved, and so wholly unlike their surrounding neighbors, or indeed any other race upon the continent of Asia—to be thus alone in this corner of a continent, walled in apart from all neighboring races? We may reasonably doubt the assumption of any spontaneous growth in the country they now inhabit. Conjectured migrations among still speechless societies, at an epoch anterior to the formation of nations, are beyond our present ability to trace. We can only surmise whether each continent evolved a type of manhood separately, or whether all higher races have resulted from the various differentiations and dispersions from a single locality, of a common ancestor already developed up to the lowest types of a speechless animal, tending to manhood.

Our best researches indicate an enormous antiquity for man on the American continent, and an advance in general form and brain capacity, with, doubtless, a modification of color, since a very early period. In very remote times, there appears to have existed at least two very distinct populations, differing, in fact, more widely than any existing aborigines of the continent. Portions of North America had been occupied by races far more advanced than its occupants when recently discovered by Europeans. Originating, perhaps, at a very early period in the elevated centres of the American continent, wave after wave of races may have rolled eastward and westward, or northward and southward, to a certain extent, only identified in America to-day by slight signs that mark the nearly extinct descendants of the people with which they amalgamated.

Dogmatic theology retreats before scientific truth. No one will, at this day, pronounce the self-registering records of nature grave heresies. They are vastly more enduring, authentic and reliable testimony than the precarious text of human narrators. It seems a crime against true religion to hang the integrity of its moral principles upon the validity of statistics in any book which merely illustrates, by historical parables, the early development of its traditional ideas. The innate virtue of its pure principles is unharmed by legendary or dogmatic absurdities.

The Chinese have an immense antiquity. They are a peculiar people, very marked in their features, and have multiplied so that at present their population and area of production are so balanced that any marked increase would precipitate a famine, and thus equalize conditions. They not only practice economy, but enjoy it, having learned in centuries to live upon the minimum and enjoy the maximum of life.

All other civilizations and emigrations throughout Asia appear to have moved from Asia Minor, and the high central portions of the North and West. The Chinese appear as an isolated people, and have long preserved the peculiar type of a race wholly unlike any other on the continent of Asia. Their country is situated upon the south-eastern extremity of the continent, and hemmed in on the west and north by a chain of mountains practically impassable, and now made more so by the great wall, 1,250 miles in length, with which, B. C. 220, they sought to complete their isolation.

If this people did not develop from the soil they now occupy, we must search for the most probable mode of access by which their earliest ancestry reached their present home. In this stage of the world, all nations are more or less composite.

The southern and south-eastern portions of China border upon the ocean, and if the earliest Chinese came from an opposite direction they must have reached their country by water. If so, it may account for their skilled boatmen, who have lived upon the water from time immemorial, and for the enormous fleets of junks, generally of large dimensions, which they possess. A taste early cultivated may have come down through many centuries.

If we first seek for testimony from Chinese records, we find they ascribe their own origin to the southern portion of China. In order to ascertain how they could have reached there by sea, and the direction whence they probably came, we must study natural causes, and seek among winds and currents for the first natural distributing agents, whose influence on navigation has been but recently overcome by clipper ships and steamers of modern construction.

The Pacific is a wide ocean to cross, and fair winds must have been relied upon, for muscles could never have paddled a direct course for such a distance. Where, therefore, is the country, from which they could follow a fair, fixed wind in a straight course, and be brought to land upon the southern coast of China, where they claim to have originated?

We find in the South Pacific, between the southern tropics and the equator, a perpetual trade wind blowing from the south-east. Towards the tropics, it blows more nearly from the south, hauling gradually into the eastward as it approaches the equator. This constant breeze would drive a vessel kept before the wind, from a point anywhere on the coast of Peru, about in the neighborhood of the Chin-cha Islands, by a slightly curved but almost direct line as far as the equator in the direct course for the coast of China.

In the North Pacific Ocean, between the tropics and equator, the north-east trade wind exists, as the almost complementary counterpart of winds in the southern hemisphere, likewise blowing more northerly near its northern limit, and uniting in an almost due easterly wind near the equator. Thus the south-east and north-east trade winds meet, and frequently blow into each other along a parallel line, making a continuous fair wind, uniting them at the equator, and consequently forming an uninterrupted motive power, to their western limit.

Now, if a large junk were started from the coast of Peru, near Central America, and kept off before these fair winds, there is a strong probability that in sixty days she would strike the southern coast of China, about where early Chinese traditions place the origin of their race. This evidence, of natural causes, apparently points to Peru as the possible home of the Chinese ancestral race. What has Peru to offer in support of such an hypothesis?

In Heaviside's "American Antiquities," published in 1868, we find that "some of the western tribes of Brazil are so like the Chinese in feature as to be almost identical." There is thus a *possibility* shown, that the ancestry of China may have embarked in large vessels as emigrants, perhaps from the vicinity of the Chincha Islands; or proceeded with a large fleet, like the early Chinese expedition against Japan, or that of Julius Cæsar against Britain, or the Welsh Prince Madog and his party—who sailed from Ireland, and landed in America A. D. 1170, and, in like manner, in the dateless antecedure of history, crossed from the neighborhood of Peru to the country now known

to us as China. The very name, Chin*cha*, has a Chinese sound, and reads China, with two letters dropped.

For upwards of twenty centuries, Chinese junks are known to have been large, fast, and strong; their people skillful mariners, excellent carpenters, and marine architects. They early possessed the mechanical skill to build junks of comparatively great tonnage, capable of conveying large amounts of cargo and great numbers of passengers. If the measurements of Noah's ark are correctly interpreted, she was larger than any ship of our day. Ship-building, as we have shown in a previous paper, is a very ancient art, known long before the days of Tarshish. We have no history of its absolute inception. Monuments on land endure to perpetuate the memory of a race, but ships are of their nature perishable. A race that could build the magnificent temples and pyramids of Palenque and Copan, in Yucatan, could certainly have their fleets upon the Pacific Ocean, in ages long before any existing record. The construction of a Peruvian or Central American fleet of large vessels, in early ages, capable of transferring to China, if not 100,000 people, certainly quite sufficient to establish a colony, would require far less skill or enterprise, than that which raised the pyramids of either Central America or Egypt.

China had bronzes in perfection during her very earliest ages, and may have introduced them into Western Europe and Asia. Among the most ancient relics found in Peru, are bronze and iron implements. Many Peruvian and Central American antiquities resemble, not modern Chinese, but their most ancient writings and figures. It is not impossible that Cadmus' alphabet, as well as the hieroglyphics of Egypt, may have been suggested and developed from the ancient American hieroglyphics now coming to light, showing such similarity and apparent connection, and which many scholars already consider as the early models, not the results, of Egyptian figures and Chinese ideographic characters.

The Toltec race in America had a god with one arm—so had the Egyptians. The deified Fo—whom they represent with two small horns, similar to those associated with figures of Moses, the Hebrew lawgiver—instructed Chib-ca Indians in Bogota to paint the cross and trigrams used on their inscriptions; and in China, the Chinese historians ascribe to Fohi many new things, among others, how to paint identical figures of trigrams, like those found among the ruins of Central America. With time and perseverance, it may yet be discovered that a knowledge of hieroglyphics came from Peru or Central America to China--a people whose growing commercial intercourse may have spread their knowledge to the ancient monarchies of Egypt.

The recital of facts may be greatly extended, showing a wonderful chain of evidence, which it is hard to conceive can be entirely accidental and coincidental, unless we take the extremely broad and apparently untenable ground, boldly asserting that primitive humanity, through the action of common laws and natural forces, wherever placed, evolves like forms, customs and necessary results, irrespective of variable conditions and individual fancy or free will. Chinese ideas concerning the Tchin, or original eight persons of a supernatural nature who escaped from the sea, point to an origin from beyond seas, or to an early piscatorial age. B. C. 3,588, Tai-ko-Fokee, a king of China from abroad, was deified. China has her ancient pictorial writings.

Fernando Montesino, a Spanish historian, who visited Peru and published his work from 1508 to 1547, says Peru was thickly populated, and had a catalogue of 101 monarchs, with notes of the memorable events of their reign, extending to B. C. 2,655.

Hawks, in his Peruvian antiquities, says that before the Spanish conquest, in the most eminent period of the dynasty of the Incas, the vast empire of Peru contained eleven million inhabitants, which rapidly diminished, until the census of 1580 shows but 8,280,000, and now the valleys of the Peruvian coast contain barely a fifth of what they contained under the Incas. The total present population by census of 1875 amounts to only 2,720,735 souls. A light native is still called a *China-Chola.*

The feast of souls practiced in Central America appears to have been derived from the same source as that of the ancient Egyptians. The Jesuits of the Propaganda report these ceremonies as anciently in practice in China. The ruins of ancient temples found in Central America resemble in form, space, and massive walls, *without roof*, the most ancient temples of Egypt, and many of the carvings are singularly alike.

Traditionary histories among the different groups of the Polynesian Islands indicate that the Hawaiian race came there from the south. The Hawaiian Islands are nearly in the direct line from Peru to China.

While the majority of Hawaiians are probably descended from Malays, their early traditions tell us of the landing of men belonging to a race whiter than their own, upon the southern island of Hawaii, many centuries ago, whom they were at first inclined to consider as gods, but who finally settled among them, and from their wisdom were elevated to high positions. These men undoubtedly came from Central America or Peru, and may have been from the ancient Peruvian empire, or the later kingdom of the Incas, or from that early civilization whose traces yet remain in Yucatan.

It has been sufficiently demonstrated that even frail canoes and boats, either by accident or design, have performed voyages across wide oceans. In 1819, Kotsebue found at Radack group four natives of the Caroline Islands, who had been driven eastward in a canoe 1,500 miles. In 1849 men came from Honolulu to San Francisco, 2,300 miles, in whale boats. And more recently the boisterous Atlantic ocean has been crossed from New York to Liverpool by a solitary man in a dory.

A dozen of the crew of the clipper ship "*Golden Light,*" burned in the South Pacific about 1865, just west of Cape Horn, reached Hawaii in eighty-one days, in a whale boat under sail, and would have run upon the reef at Laopahoihoi, but for natives who swam off to rescue these exhausted people, all of whom survived.

While we have cited facts showing it reasonable to suppose that early Peruvians or Central Americans may have come to China, by the aid of continuous fair winds, it is no less necessary to show the almost insurmountable difficulties which exist during a greater part of the year to impede their return by sea. To beat back against strong trade-winds and the long regular seas of the Pacific, would be a task in which they would surpass our best modern clippers, which now can only make the voyage by running far north and crossing from Japan to the coast of California, upon the arc of a great circle,

and sailing thence southerly, close hauled on the wind, to the neighborhood of Tahiti in the South Pacific, which must then be crossed in an easterly direction, south of the trade winds, which in turn enable them to make northing and reach the coast of Peru. Such a return voyage would require the most skillful knowledge of winds, coasts, and scientific navigation, such as we have only possessed in comparatively recent times, and would also require exceedingly strong and weatherly vessels. There seems, therefore, less likelihood that any Chinese ever reached Peru in pre-historic times by such a route.

Intercourse appears to have existed more recently, but how far it was reciprocal remains to be seen. If it was commercial it was more likely to have been, as reciprocity is the foundation of trade.

In our search for objections to the theory we are exploring we however, find other possible channels of return communication. During the southwest monsoon a fleet of junks might possibly have left China and followed the Kuro-Shiwo, or warm stream that flows along the coast of Japan, with summer winds across to the northwestern coast of America, near our own harbor, and thence gradually have worked its way southward to Central America, keeping along in sight of the coast until it reached the calm belt around Panama. The Abbé Brasseur de Bourbourg makes this statement: "There was a constant tradition among the people who dwelt on the Pacific ocean, that people from distant nations beyond the Pacific formerly came to trade at the ports of *Coatulco* and *Pechugui*, which belonged to the kingdom of Tehuantepec, in Central America. Baldwin tells us, in his "Pre-historic Times," that "the traditions of Peru told of a people who came to that country by sea, and landed on the Pacific Coast. These may have been from the great maritime empire of the Malays, whose dialects have permeated almost every island in the Pacific oceans. Lang says: "South Sea Islanders exhibit indubitable evidences of an Asiatic origin."

The continent of Asia affords more facilities for reaching Polynesia than America, although stragglers from the latter have doubtless added to its island races, and thus created a mixture of customs which, to some extent, may indicate a partial derivation from both. Probabilities favor Asia, both from certain affinities of tongue, striking resemblance in manners, idols, and physical formation.

Commercial intercourse, although not direct, existed and was maintained between China and Egypt, B. C. 2000. Chinese traditions claim for their people the first use in Asia, of ships and the earliest knowledge of navigation and astronomy. Their people first acquired the mariner's compass and believed the sacred magnetic influence proceeded from Heaven, which they located in the South, and from which they claimed to have come. To this day the heads of Chinese compasses point south.

In Peru, the oldest civilization was the most advanced, and had the highest style of art and mechanical skill. "Her people had an accurate measure of the solar year; a knowledge of the art of writing; and made paper of hemp or banana leaves B. C. 1800." The aboriginal Peruvians have had their dark, as well as bright, ages in history. They may have retrograded while their possible offshoot, the Chinese, progressed. Young colonies often grow and prosper, while their progenitors reach a climax and die out. Dis-

solution is the countercharge, which every material aggregate evolved, sooner or later undergoes. Evolution and dissolution bring to us ever changing, but eternally advancing forms, in their cycles of transformation.

The establishment of a race may be possible from a single pair, of strongly marked distinctive characteristics, whose descendants have continually intermarried. Hebrew patriarchs founded nations, and nations thus springing from a single man of pronounced character, whose descendants remained united and isolated, have often developed strong and peculiar personal characteristics, which have pervaded and stamped themselves upon the race thus descended. Mixed or cosmopolitan races, never possess uniform characteristics as clearly defined.

It seems more reasonable to infer, that a fleet from the neighborhood of Peru may have reached China with the first emigration, perhaps bearing a hero-sovereign and an invading army, which, once landed, found China agreeable, and, being unable to return against those perpetual winds which brought them so swiftly, were compelled to establish themselves in new territory.

Writers on Central America have expressed a decided opinion, that the peculiar character of its ancient civilization, manners, customs, and general structure of the ancient language, point very strongly to a common origin between the Indo-Chinese nations of Eastern Asia and the ancient civilization of America, which appears, in some remarkable particulars, to have been of an Egyptian cast. The Coptic or ancient Egyptian language, however, seems to have been monosyllabic. Hieroglyphic writing is of three kinds: figurative, symbolical and phonetic. Hubert H. Bancroft, in his Native Races of the Pacific States, Vol. V, f. 39, says: "Analogies have been or thought to exist between the languages of several of the American tribes and that of the Chinese. But it is to Mexico, Central America, and, as we shall hereafter see, to Peru, that we must look for these linguistic affinities, and not to the northwestern coasts [of America], where we should naturally expect to find them most evident." Count Stolberg, quoted by Humboldt, is of the opinion that the Peruvian cult is that of Vishnu—one of the Brahmin trinity—when he appears in the form of Krishna, or the Sun.

Mexican kings, who reigned previous to the Spanish conquest, all added TZIN to their names as a reverential affix. It resembles in sound a dynasty of China—the Tsin dynasty—which reigned from B. C. 249 to B. C. 205. Tai Ko Foki, the Great Stranger King of China B. C. 3588, or later Hoang Tai, may have landed from such a fleet, and been called by conquest, or through the reverence of superior knowledge, to reign over them. The descendants of these early settlers may have remained clannish, keeping apart, as an entirely distinctive race, from the Miauts or original aborigines, naturally following the customs of their forefathers, and thus have increased and grown into a mighty nation, unlike all people around them.

During many centuries of growth, China, like Japan and Corea, became a sealed empire, when no possible admixture of foreign blood could occur. It seems to have become an established habit with these nations to periodically close their ports to foreign intercourse. Some similarities of race exist between some types of the Coreans and Japanese, while the Chinese are

quite singular and unlike. Their oriental peculiarities, which strike the casual observer, are their dress, shaved heads and queues, habits, odor, and guttural language. Chinese are the only nation on the continent of Asia that use chairs and tables. Isolated nations, like hermits, cannot escape being distinguished by eccentric habits. Now, if the high civilization of Peru, which was in full tide B. C. 1800, and probably many centuries before, crossed to China in very early days, bringing its accurate measure of the solar year, and the arts of making paper and writing, all the necessary material was furnished China for the production of correct and reliable historic records. In reviewing Chinese early history, we have found that, B. C., Tai Ko Foki, their Great Stranger King, introduced a knowledge of these things, with hieroglyphic characters, and first divided time for them into lunar months and solar years. And we have shown that the authentic comprehensible history of China begins with his reign.

Now we inquire, did Foki, with all this valuable knowledge, come from Peru B. C. 3588, and settle among a pre-existing people, perhaps similar to, if not the aboriginal Miautz, long since driven from the plains of China into the almost inaccessible fastnesses of its mountain barriers?

A knowledge of days already existed among the sun-worshipers of Asia, who doubtless kept their records in days; but the introduction of a scale measuring by months and years placed their history on a footing we can comprehend; and the introduction of the art of writing enabled them to perpetuate it by enduring records. When we discover the measures of time, used to gauge ancient histories before these improvements were introduced, we shall doubtless find their records reasonably authentic. We have as little understood their stupendous figures as strangers conceive the value of a Brazilian rea, some 1000 of which, make a sum equal to the United States dollar; and accounts involving such currency bear the formidable aspect of immense sums, to the uninformed. With advancing centuries, the measure of time doubtless lengthens.

After the children of Israel left Egypt, where the solar year was known, records of extreme longevity disappear, and ordinary terms of life are adhered to. We should judge cautiously, and refrain from any interpretation at variance with human reason and common sense. The lunar changes, without doubt, were employed in the measurement of time in all warm climates before the introduction of the solar year. The colder the winter, the more marked the year became as a measure of time. Day and night would naturally suggest themselves as the first measure. Peruvians, Chinese, Egyptians, Hebrews, Japanese, Polynesians, and others, all attribute great longevity to their earliest ancestry, until the introduction of higher mathematics and the solar year.

The oldest histories preserved to us become what in our day we call authentic, when their nations acquired the art of writing, and divided time in a regular and uniform manner, by the solar year.

The first and fabulous epochs of most histories begin with dynasties of deified warriors. The tendency to deification exists among all early nations, and we need not go out of our own history to prove it. Edmond the Confessor, the Archbishop of Canterbury, who died as late as 1242, was canonized as a

saint, only a differentiated form of the same tendency. The gods of antiquity were partly impersonifications of natural forces, and partly deified men. They often bear the same relation to facts that shadows do to forms, being at worst but simple distortions of the truth. Few nations can examine impartially the substratum of their ancestral religious creeds. How often do we find in dogmatic theology the imprint of early paganism? The Hawaiian nation is supposed to have a considerable antiquity. From time immemorial there have been persons appointed by the government to preserve, unimpaired, the geneology of their kings, which in 1863 embraced the names of more than seventy. Allow an average reign of twenty-five years, this would throw their history back 1,750 years, to A. D. 117 or earlier, say to about the Christian era.

It was a custom throughout the islands of the Pacific to exterminate their enemies, either by killing or setting them adrift in canoes. The latter practice not only led to the peopling of the various Polynesian islands, but was also a cause which led to cannibalism, for want compelled the exiles to subsist on each other, and a taste once indulged in, was continued by survivors who succeedeed in reaching some island, and thus cannibalism became established. North American Indians have never been cannibals.

When Spaniards first visited America, the western equatorial regions of the continent were the seats of extensive, flourishing and powerful empires, whose inhabitants were well acquainted with the science of government, and had evinced considerable progress in art. Roads fifteen hundred miles long, remain in Peru, relics of the past, as ancient as the Appian way. In very remote times social etiquette was observed and universally respected. The early Peruvians constructed suspension bridges across frightful ravines, and moved blocks of stone as huge as the Sphinxes and Memnons of Egypt. They built aqueducts of baked clay and constructed dykes and causeways, and preserved a memory of past events by picture writing. They had a language of ceremony or deference, with reverential nouns and verbs, with which inferiors addressed superiors, a feature of resemblance to the Chinese in Eastern Asia.

Ruins of extensive cities and fortifications are now found in Yucatan and regions of Central America; the elevated plains of Bogota and *Cundinamarca;* the open valleys of Peru; and the lofty, secluded and highly fertile tracts of Chili. These colossal remains of ancient primitive civilizations are passing from the memory of a degenerate offspring, who now behold with indolent amazement these interesting relics of their illustrious predecessors. The origin, history and fate of these powerful nations of America, who have left behind them such colossal memorials of an ancient civilization, is a study of profound interest. Stones, thirty by eighteen by six feet, are squared and hewn and reared with utmost exactness. Their style of arch is peculiar. Temples, pyramids, tumuli, and fortifications, with remains of buildings of singularly massive architecture, often exquisitely carved, betokens a civilized antiquity.

It seems impossible that these people should have passed from the continent of Asia by Behring's Straits, for no traces of any such people remain anywhere along that route.

Pyramids of remote antiquity are found in India, China and Tahiti, as well as in Egypt and South America. Those of Egypt are in the best state of preservation and perhaps therefore the most recent.

The learned Bavarian, Dr. Von Martius, regards the evidence incontrovertible "of the existence of the *aborigines of America* long anterior to the period assigned in Hebrew chronology for the creation of the world;" a race whose utter dissolution manifests that it either bore within itself the germ of extinction or attempted an existence under most fatally unfavorable conditions.

Dr. Clarke says: "No race of human kind has yet obtained a permanent foothold upon the American continent. The Asiatics trace back their life in Asia so far, that the distance between to-day and their recorded starting-point seems like a geologic epoch. The descendants of the Ptolemies still cultivate the banks of the Nile. The race that peopled Northern Europe when Greece and Rome were young, not only retains its ancient place and power, but makes itself felt and heard throughout the world. On the American continent, races have been born, developed, and disappeared. The causes of their disappearance are undiscovered. We only know that they are gone." It remains to be seen if the Anglo-Saxon race, which has ventured upon a continent which has proved the tomb of antecedent races, can produce a physique capable of meeting successfully, and advancing under, the demands that our climate and type of civilization make upon it. This is an interesting query.

If we have been utterly confounded in contemplating the stupendous monuments of Egyptian magnificence, which continue to defy the ravages of time, what shall be said of remains of more ancient pyramids and colossal figures in America, of a style and character analogous to those of ancient Egypt, whose very stones are crumbling to decay, and on whose flinty sides verdure has crept over the dust of ages, until ancient and gigantic forests have acquired root-hold, and grown over their very summits? Many an Alexander and Napoleon of pre-historic times has gone to his rest, and left no record, capable of enduring to the age we live in, to mark the glory of his empire. Many mummies are found in Peru, enveloped in bandages of fine cloth, while the bodies of kings are admirably preserved by means of a secret known only to the royal family.

In the far distance of remote antiquity, successive peoples have risen to importance and passed away, long ages before the birth of those from whom the faintest ray of civilization has remained to cast even a feeble reflection of its pale light upon the fading pages of our most ancient historic records.

A period has undoubtedly existed, in the primitive history of our earth, when the necessary equilibrium between its external and internal forces has been lost. When the external pressure on the crust became diminished by the sublimation and recomposition of external elements, which, when refined and advanced, were unequal in density to the expansive force of igneous materials confined in the interior mass. The solid enveloping crust of our sphere is the medium constantly acted upon, by these contending forces, in seeking a state of equilibrium. Geologists direct us to many prominences in which the upheaved strata, on one side, is abruptly broken, and on the other, gently inclined. Such ruptures could not have been gradual, for in places the whole combined strata is fractured, depressing portions, and rais-

ing others to immense heights. Earth's surface, to-day, bears unmistakable evidence, to every thoughtful student, that eruptive catastrophes have materially changed its geological features—especially the levels. Many areas, formerly submerged, are now dry, and known as alluvial formations. Seas have changed position, and rivers acquired new courses. New land has been formed, and mountain ranges reared by upheaval. Recent deep-sea soundings of the U. S. steamer *Tuscarora*—commander, Belknap—clearly illustrate how largely the bed of the Pacific Ocean—once but an extended valley, running, perhaps, from the Arctic to the Caribbean Sea—may have augmented its area by a comparatively moderate depression. During the glacial period, immense icebergs were produced at the poles, and as they increased in bulk, during a succession of cold winters, they accumulated an enormous volume of water—human life is considered to have been extant at this period—and when a succession of warm summers, produced by the perpendicularity of the earth's axis to the plane of the ecliptic, succeeded in reducing these huge accumulations of polar ice, its volume retired, covering many valleys not previously submerged. This could have given rise to the legend of a Flood, which may have occurred, but could not have been universal, for a sufficient amount of water does not exist to cover the highest mountains, and submerge the entire earth.

A sudden and eruptive convulsion of earth's crust during the tertiary, near the close of the cretaceous period, whether separate or conjointly with a flood, must necessarily have destroyed a large majority of partially developed men, struggling to evolve the higher human types. Portions of Asia, Africa, and Australia are supposed to have been elevated; while Europe, the extreme northern portions of America, the Caribbean Sea, and the beds of certain oceans were depressed. The effects must have been most forcible around the poles and south of the equator. Dead river beds which cross the highest mountain ranges of the Pacific Coast, and yield so largely of gold to hydraulic washing, clearly confirm radical changes in the physical conditions and levels of this coast.

The surviving remnants of these catastrophes, in Asia, Africa, Yucatan, and a few scattering tribes of North America, thenceforth appear as the progenitors of all living nations. It is only from this period that we can hope to trace the early history of humanity. Previous beings, if in harmony with physical conditions, must have been generally in the incipient stages of human evolution. In Central America alone, we find ruins, whose hoary antiquity seem to claim for its inhabitants the earliest civilization of which any traces remain. It is fair to infer that the pyramids of Yucatan were antediluvian and escaped inundation, as did the cities of Palenque and Copan. These elaborately constructed cities of Central America exhibit conceptions of beauty which, as early specimens of a gradually unfolding art, appear to antedate all similar structures extant.

Plausible grounds of inference exist, that the earliest manifestations of culture known to us, was among the primitive settlers of Central America, who, having acquired mechanical invention, art, and the rudiments of science.

built dwellings and temples, which yet endure as testimony of their progress. Although their minds were doubtless uncultivated in those higher branches of knowledge and refinement which ensures perpetuity to national life, they seem to have led the world in the early use of language, and the adoption of picture-writing to record and communicate ideas.

The sun, which was long the national emblem of Central American nations, is the absolute basis of mythology. It seems probable that Yucatan once extended over the present bed of the Gulf of Mexico, including the West Indian Islands. The Caribs may be a degenerate remnant of some aboriginal race. The ancestors of our North American Indians were very uncultivated in their physical, mental and social condition.

Long before Egypt, the progenitor of Greece and Europe, was settled, the inhabitants of Yucatan appear by their monuments to have been well advanced in general intellectual attainments, and to have led all known nations in art and science. Why may not a branch of this people have emigrated to China and Egypt, and there have become a large and advanced nation ?

Many things unite to prove that China, at the opening of her treaty ports to European trade, was unmistakably retrograding in the physical as well as social organization of her people. Her highest prosperity is thought to have been reached about the reign of Genghis khan.

Agassiz tells us that, geologically considered, America is the oldest continent. If so, why should we not look to it, as the spot where the human race first gained ascendancy, and acquired its primeval home? If its primitive races have died out, and stone pyramids crumbled beneath the dust, is it not a strong argument in favor of her antiquity? In Asia, traces yet remain of original races, whose earlier civilization in America, under different physical conditions, *has had time* to culminate, dissolve, and *fade from sight*. When, in the early development of America, progress was sufficient to facilitate emigration, why may she not have furnished population to Asia? In submitting this question, with evidence calculated to warrant further study, and outlining various channels for investigation, we aim to attract for it that scientific attention which, as an ethnological problem, it fairly deserves, hoping some satisfactory answer may be attempted, before facilities for interrogation yet available among American aborigines, shall have passed away forever.

This imperfect collection of facts is laid before the Academy in its present condition, not in any way to ask for present endorsement, but to awaken new sources of inquiry among thoughtful ethnologists, which may ultimately lead to a discovery of the truth. A large mass of additional facts bearing upon this subject require more labor than I have yet found time to bestow, and would also unreasonably swell this already lengthy paper, which is offered as a simple inquiry, suggested to careful and technical scientists, who, by comparing physical, embryological, and linguistic characteristics, pertinent histories, and traditions, may in future establish or disprove the possibilities here shadowed forth.

REGULAR MEETING, MAY 17, 1875.

Vice-President Edwards in the Chair.

Fifty members present.

Gustave Mahé and Ernest L. Hueber were elected resident members.

Joseph L. King and Pembroke Murray were proposed for membership.

Donations to Museum: Sponges and tertiary fossils from San Diego, by Henry Hemphill; concrete gum, from C. B. Smith; archil from Mazatlan, and Epiphites (Abies Douglassii), Henry Edwards; fragments of wood from a well 180 feet deep in Alvarado, Alameda County, California, from John Hall; Indian Mortar, from Amos Bowman; fine specimen of peacock (mounted), from James Lick; portion of skull of *Ursus horribilis*, from M. O'Hara; snake from Master Willie Lockington.

Wm. Guerin read a paper on "The Sewage System of San Francisco."

Mr. Stearns read a paper by J. E. Clayton, of Salt Lake, as follows:

The Glacial Period—Its Origin and Development.

BY J. E. CLAYTON.

In the summer of 1860, I discovered the markings and terminal moraines of the Glacial system of the Sierra Nevada mountains, on the head waters of the Merced and Tuolumne rivers.

Upon my return to San Francisco, I reported the facts to the California Academy of Sciences. Since that time I have been a careful student of the glacial phenomena presented on the western slope of the continent. In other portions of the world, the phenomena of the Glacial period have engaged the attention of scientific investigators, ever since geology became a science.

Many theories have been suggested to account for the sudden change of the climate of our planet, at the close of the tertiary age, from temperate and tropical heat to that of arctic cold. The theories put forth by the ablest

writers on the subject have failed to account, satisfactorily to my mind, for the most important facts observed. Many of these theories are based upon an assumption of conditions and causes that cannot be maintained by logical deductions from the general laws governing the progressive development of the planet.

I will review briefly some of the theories put forth by eminent scientists, by which they attempt to account for the great changes in the climate at the close of the tertiary age.

THE FIRST THEORY

Is, that there occurred a great upheaval of land in the Northern Hemisphere, by which the currents of the ocean and of the atmosphere were greatly changed or modified, and that this great elevation above the ocean level was the primary cause of the change of temperature. This line of reasoning appears to me untenable, for the following reasons: 1st. If the elevation of the land surface had of itself sufficient influence on the climate to produce the Glacial epoch, it ought by the same law to have continued that condition until the present time, and to an indefinite period into the future ages. As this supposed cause has not been sufficiently potent to continue glacial conditions, it therefore follows that it was not the primary cause of climatic changes, but was merely a modifying influence, in so far as it changed to a limited extent the direction of the air currents.

2d. The thermal effect of the sun's rays upon land surfaces is much greater than upon water surfaces. Hence the atmosphere becomes heated by its contact with the land even at great altitudes. The land surface of the North American continent will probably not exceed an average altitude above sea level of more than two thousand feet. Compare this altitude with the different heating power of the sun's rays upon land and water, and the change would in all probability be an increase of atmospheric temperatures.

3d. The effects of the elevation of the continents would be to largely increase the land surfaces, and correspondingly decrease the areas covered by water. The interior basins or inland seas would be drained off, the watersheds steepened, so that the surplus rainfall would be rapidly drained into narrow, swift-running streams, thus reducing the sources of vapor to very narrow limits as compared with the water surfaces in the beginning of the tertiary age. It therefore follows that a largely decreased evaporating surface, and a correspondingly increased thermal effect of the sun's heat, could not supply the conditions for a continental glacier system. Hence I conclude that the elevation of land surface in the Northern Hemisphere was not an adequate or primary cause of the Ice period.

SECOND THEORY.

Some investigators suppose that, by some means, the relative positions of the poles of the earth have been changed, so as to bring the then frozen zone into the range of the now temperate and tropical latitudes. As a proof of this, they cite the facts that the remains of vegetable and animal life, that are

now peculiar to the tropics, are found in abundance in the polar regions of our time. By what means a self-balanced rotating globe could change the position of its mass, without changing its line of rotation, is not shown by the advocates of the theory; and unless the cause of such change can be clearly shown by facts that cannot be accounted for in any other way, the theory cannot be accepted as even probable.

If the general proposition is true, that the earth was originally incandescent, and has been slowly cooling through past ages by radiation, it follows that the conditions for tropical life must have begun near the poles, and progressed toward the tropical zone, in harmony with the changes of climate. If no violent disturbances of level had taken place, the change would have been slow and almost imperceptible; but we know that violent changes in the earth's crust have taken place, and have produced rapid if not sudden changes in the temperatures and climates of its surface. These changes have been sufficiently violent to destroy the characteristic types of life existing at the time, and mark a distinct period in the progress of the globe toward its present condition. I therefore conclude that the theory of a change of the poles of the earth is not susceptible of proof, and therefore unworthy of serious consideration.

THIRD THEORY.

Another class of investigators, failing to apprehend the true causes which produced the Ice period, have proposed the theory that the solar system, in its sweeping circle through space, has encountered or passed through frigid zones in the stellar spaces that reduced the surface or atmospheric temperature to an extent sufficient to give an Ice period to our climate.

This theory, like the one above considered, has not been proved by any well considered facts, neither is it susceptible of proof by any known means within reach of human investigators. If this theory were true, the waters of the globe would have been frozen where they now are, and could not have been transferred to any considerable extent, by evaporation and condensation, upon the land surfaces.

The extinction of life would have been a slow, starving and "freezing out" process, that could in no reasonable way account for the facts of glacial times. The conclusion therefore follows, that cosmical influences had nothing to do directly, in producing the Glacial epoch at the close of the tertiary age. The facts, so far as I have been able to trace them out, all seem to indicate that the geological disturbances and volcanic eruptions that occurred at the close of the tertiary age, together with the return trade winds, were the only causes, ample and sufficient to produce the facts and phenomena of glacial times.

The question then may be asked here: What are the conditions necessary to produce a glacial period? The answer is plain and simple: 1st. A folding and dislocation of the earth's crust along great longitudinal lines (N.-S.) along the western borders of one or more continents. 2d. The issue of interior heat, followed by great outflows of lava along such lines of fracture. 3d. The local vaporization of the waters of the surface by contact with the lava

outflows and other points of escaping heat. 4th. The ascent of the vapors to a height sufficient to penetrate the return trade winds, or upper currents of the atmosphere. 5th. The general depression of the ocean beds, and corresponding elevation of the continents, and development of the great mountain chains of the globe.

That such conditions and facts did occur at the close of the tertiary age, substantially in the order named, is well known to every practical student of Geology. That such conditions and facts, in conjunction with the upper currents of the atmosphere, were ample of themselves to produce and would of necessity cause the glacial epoch, cannot, in my opinion, be seriously questioned.

To bring this subject clearly before the mind, it will be necessary to make a brief survey of the physical geography of the continents during the tertiary age. The geological records, so far as science has been able to trace them out and interpret their true meaning, show that, in the beginning of the tertiary age, the continents over their largest areas presented low, undulating surfaces, but slightly raised above the ocean level; that large districts were covered by fresh-water lakes and inland seas, some of them at one period presenting the forms of life peculiar to marine and brackish waters, and at other periods only such living forms as are known to exist in fresh water—thus proving that slight oscillations of the earth's surface were sufficient to cause the oceans to invade some of the interior basins of the continents and fill them with salt water. Hence, in many of the tertiary formations, we have presented the various forms of life peculiar to marine, brackish, and fresh waters. During the progress of the tertiary times, great changes of level were produced over large continental areas, until they became mostly dry land. In the later tertiary period, the marine deposits were gradually confined to the low borders of the continents, and the interior basins became filled exclusively with fresh water, and only fresh-water deposits were formed in their beds.

The climate of tertiary times fluctuated from a tropical warmth, that was well nigh universal over the globe at the beginning, to temperate and even Arctic cold in the higher latitudes, where great elevations of mountain chains occurred in the later periods. At the close of the tertiary age, the disturbances of the solid crust of the earth were enormous. Great mountain chains were elevated on all the continents, accompanied with corresponding depressions of the ocean beds, thus confining the oceans to narrower limits and increasing the land surfaces above the waters.

This last grand change of land and ocean levels must have occurred mainly by sudden convulsions and re-adjustments of the earth's crust. The continued radiation of heat from the fluid nucleus of the globe caused its continued shrinkage. The consolidated crust conformed to this shrinkage by corrugations and oscillations of level. The sinking down of the ocean beds and elevation of the continents went on slowly through the long periods of the tertiary age, until the lateral pressure of the earth's crust became so great that it culminated in a series of dislocations and uplifts over all the continents of the globe. The ocean beds were doubtless equally disturbed and broken, so as to relieve the lateral pressure caused by the shrinkage of the interior.

The immediate effect of this relief of lateral pressure would be the settling down of the broken, folded, and dislocated crust with nearly its full weight upon the molten mass of the interior. This would cause the outflows of lavas through the broken lines, until the fluid and solid portions of the globe were balanced according to their relative densities and weights, just as water will ascend in the fissures of broken ice to the points of equal weight. It would appear from this line of reasoning, that the greatest outflows of lava ought to have occurred where the greatest downward folding took place; and this is strongly indicated, if not proved, by the islands of the oceans being nearly all of volcanic origin, and the lower flanks and plateaus of the continents having the greatest lava outflows.

While we must admit that the changes of level over large areas of the globe were very slow, and extended through long geological periods, we are still forced to the conclusion that sudden changes of vast extent have taken place at the close of the principal eras. These convulsive movements not only changed the relative positions of the land and ocean levels, but also swept away all living forms peculiar to the geological age that was terminated by such changes. The general results following such violent terminations of geological ages would be—

1st. The escape of enormous quantities of interior heat, accompanied by great lava outflows along all the principal lines of disturbance.

2d. The consequent vaporization of large quantities of water, continued through the period of disturbance, and until the lavas were cooled and all the principal vents of escaping heat were closed. In the earlier geological periods, when the average temperature of the earth and atmosphere was much higher than it is now, the waters vaporized during periods of volcanic or igneous activity would descend in floods of rain; but in later times the general temperature became so much reduced by the radiation of heat, and the crust of the earth had become thickened to such an extent, that the atmospheric temperature was dependent mainly upon the influence of the sun.

Under these conditions, the vaporization of the waters by the outflows of lava and hot gases, at the close of the tertiary age, would give results greatly modified by atmospheric temperature. Near the points of igneous outbreak, the lower zones of vapor would descend in floods of rain; but those portions of the continents lying east of and remote from the lines of volcanic activity would be buried in enormous depths of snow. Prof. Tyndall says, "To produce a glacier, we must first vaporize the waters." I think I have indicated how the waters were vaporized. The next thing to demonstrate is the freezing of the vapors, and their distribution over the continents, especially over those portions remote from active igneous disturbances.

A careful study of the wind currents at this point becomes an essential part of the problem to be solved. The currents of the lower portion of the atmosphere are modified in their movements to a great extent by the mountain ranges and continents, but their general tendency is toward the west, as they approach the equator. The upper currents are more uniform in their movements, and they have a general tendency toward the northeast and southeast, moving spirally from the equator toward the poles, in curves of great length around each hemisphere before the polar regions are reached,

where they curve under and again become the lower currents on their return to the equatorial zone.

If the globe was a perfectly smooth sphere of homogeneous material like water, the atmospheric currents could be mapped out with mathematical accuracy; but the unequal surface of the land and the different thermal effects of land and water surfaces produce great modifications of the wind currents in certain latitudes.

This is especially the case along the west coast of the North American continent, where the polar current swings far out to the westward over the Pacific, and the return trade wind, or upper current proper, swoops down behind it to the east and strikes the west coast, and sweeps northeastward over the continent.

This fact is beautifully and conclusively proved by the trees on all the higher mountains from the Pacific coast to the summits of the Rocky Mountains. The scrubby trees in all exposed positions near the higher summits lean east and northeast; even the small twigs are bent around the limbs and trunk in the same direction, so that the whole aspect of the tree presents the appearance of reaching out to the northeast with every limb and twig. These facts show that the wind does blow in that direction (N. E.) almost constantly. The general fact is well known, and I will not go into tedious details to prove what must be readily admitted by hundreds of careful observers.

At the close of the tertiary age, the western slope of the continent was the principal scene of active volcanic disturbance. To comprehend the fearful extent of this disturbance, and the enormous masses of lava outflows, one must travel over the disturbed regions and see them. My powers of description are too limited to undertake the herculean task. The whole western slope of the continent has been broken, crushed and distorted in every conceivable manner. Districts as large as some of the smaller States have been buried to unknown depths with lava and ashes. Large rivers and great lakes were swept out of existence by the overwhelming catastrophe. The lakes, rivers and oceans sent columns of hissing vapors miles in height into the upper air currents, where they were frozen as they were conveyed eastward, and spread broadcast over the more quiet eastern slope of the continent. Thus the waters of the Pacific coast were vaporized and spread over the continent by the return trade winds. All living things were overwhelmed and buried in the sudden storms of snow. The mastodon and kindred tribes were buried up suddenly, with their stomachs full of food, their bodies loaded with fat, and not a trace of any slow process of change in climate from cosmical or other exterior causes.

It was evidently no slow, starving-out process that destroyed the animals of tertiary times, but the sudden and overwhelming effects of a great geological catastrophe.

While the elephant, rhinoceros, and other large animals were being buried in the ashes and debris near the volcanic outbreaks on the Pacific slope, the same class of animals were being covered hundreds of feet deep in snow on the eastern slope of the continent.

Those animals that were not buried, like Pompeii, in ashes and mud near the outbreaks, were overwhelmed and destroyed by the resistless floods of

rain, and the crashing shocks of the earthquakes The snow and ice period of the northeast was contemporaneous with the flood period of the Pacific coast.

No continental glacial system covered the Pacific portion of the United States, notwithstanding the altitudes were much greater; the glaciers were local, and more or less isolated, clustering around the higher peaks of the mountains.

The valleys and basins of this western volcanic region were filled with hot water, hissing steam, and volcanic products. No ice beds could form in the valleys of the Pacific; the hot rocks and escaping gases were busy, vaporizing the waters for the glacial supply of the east. No gentle snow-flakes could find a resting-place upon the table lands and valleys of the volcanic belt; but floods of rain descended, and plowed deep gorges down the steepened flanks of the recently elevated mountain ranges, thus establishing a new river system for the Pacific coast.

The most prominent examples of this are seen on the western slopes of the Sierra Nevada range, in the State of California, where the old river system has been completely buried, first by ashes and debris, brought down by the floods of water from the vents along the higher portions of the range, and secondly by broad streams of lava extending from such vents, to the plains of the valley. Notable instances occur in Tuolumne, Sierra, and Plumas counties. The portions of the old river system that were covered by the lava outflows were protected by them from subsequent denudation, and are now the summit lines of long ridges that divide the waters of the newly formed river cañons.

Under these immense fields of volcanic ashes and lava beds are found the relics of the tertiary life; and not a trace of such life has been found anywhere existing on the Pacific coast since this period of uplift and volcanic activity which closed the tertiary age.

The next notable changes were the development of the new river system, by the changes of the water-sheds and the enormous floods of water that fell for many years near the lines of escaping heat, and the formation of glaciers on the higher portions of the mountain ranges. In some places the glacial action has been traced down the slopes of the granite peak to the lava beds, and for considerable distances on their upper surfaces, thus showing that as the lavas became cooled, the ice pushed its way over their higher portions.

Here we find events well marked in the order of their occurrence:

1st. An undulating, fertile country, of subtropical or temperate climate, teeming with the living forms of tertiary times.

2d. A violent and sudden outbreak of volcanic activity, accompanied by great changes of level.

3d. The destruction of nearly all life, followed by floods of rain to an extent nowhere possible except near the sources of vaporization.

4th. The formation of glaciers on the higher mountains toward the close of the flood period, and as soon as the local temperature was sufficiently reduced to permit their formation.

These characteristic changes were not confined to the California coast. The line of volcanic activity extended from Cape Horn to Behring Strait. In

fact, the whole western slope of the American continent, from the Pacific shores to the summits of the Andes, Cordilleras, and Rocky Mountains, was in active eruption and volcanic disturbance.

If no other parts of the world had been subjected to like disturbances, the vaporization of the waters along this one great zone would have been sufficient to modify its climate; but other portions of the globe were disturbed to nearly an equal extent. And there can be no doubt about the effects of such enormous evaporation of the waters on the climate of every part of the earth; even tropical countries would be covered with snow if the vapors were sufficiently abundant and dense to exclude the heat of the sun for a series of years. The influence of the trade winds or great general currents of the atmosphere, must not be lost sight of; they were the conveyers and distributors of the vapors produced by the escape of interior heat at the various points of disturbance.

By tracing their general courses from such lines of disturbance, it is easy to determine where the greatest deposits of snow would accumulate and form the continental glaciers.

I have said that nearly all traces of tertiary animal life, were swept from the American continent. But such does not seem to be the case with Africa, India, and a part of Asia; there the elephant, rhinoceros, and many other types of life closely allied to the tertiary mammals, remain.

This important difference in the present types of life of the two hemispheres can be accounted for upon the general basis of the theories advanced in this paper. The course of the return trade winds, or upper currents of the air, is toward the east, but constantly diverging north and south from the equatorial line. The American continent is narrow in the equatorial zone, except a portion of South America.

The great volcanic activity along the Pacific slope overwhelmed the low lands with floods of water of such enormous volume, that nearly all land animals were swept off or buried in the debris from the mountains. There is no doubt but all the highlands of the tropical portion of South America were buried deep in snow, if not with glaciers. Now take the line of the upper air-currents across the Atlantic to the coast of Africa, and you will see that the divergence of these currents north and south will divide the vapors, and leave Africa comparatively free from their effects. The west coast of that continent was but slightly disturbed by volcanic activity, and there was not enough local vaporization along its west coast to give it a glacial system or flood period of sufficient volume to destroy its land animals completely.

The same may be said of portions of Asia and India. Hence the preservation of leading tertiary types in the Eastern Hemisphere, and their almost complete destruction in America, must be attributed to the operation of the atmospheric currents in conveying the vapors away from some portions of the land, while they covered other portions to great depths in snow and ice.

Some geologists assert that many of the tertiary mammals existed in North America after the close of the glacial epoch. This opinion should be received with great caution, for the reason that such remains were preserved in the ice and snow of the glacier period; and as the glacial fields slowly moved down mountain slopes and melted away in later times, the skeletons would be

deposited in lakes and alluvial deposits along rivers, and become so intermingled with the remains of more recent times, as to give them the appearance of being contemporaneous.

By referring to the researches of Agassiz, Forbes, Tyndall, and other eminent investigators of glacial phenomena, it will be seen that they admit the influence of the air-currents in glacier-building.

The great return trade-wind current, that sweeps in a curved line across Northern Africa and the Mediterranean Sea, deposits its accumulated vapors in snow upon the Alps, where the glaciers of the present time have given scientists an opportunity to study their formation and movements, and to trace out, to a limited extent, the causes that produce them.

I must beg the indulgence of the Academy and scientific investigators generally, for the incomplete and somewhat crude style in which this interesting subject has been presented by me; but I must express the hope that it is sufficient to call the attention of abler minds to the broader field it opens up for future investigations, and that it will add a little to the sum of our present knowledge of one of the most interesting periods in the geological history of our planet.

SALT LAKE CITY, February 12th, 1875.

Mr. Stearns and Dr. Blake made some verbal remarks on the subject of the above paper.

The Secretary read an extract from a letter by A. W. Kiddie, County Surveyor of Plumas County, confirming the claim of Dr. Harkness as the rightful discoverer of Lake Harkness.

REGULAR MEETING, JUNE 7TH, 1875.

Vice-President Gibbons in the Chair.

Twenty-five members present.

S. B. Christie and Frank Soulé were elected resident members.

A. W. Crawford, Dr. G. King and Dr. F. W. Godon were proposed as candidates for membership.

Donations to the Museum: From F. Gruber, specimens of green-winged teal and blue-winged teal; from Samuel Purdy, galena and silver ore from Utah, bismuth from same place, and

silver ore from Sonora, Mexico. President Davidson donated seeds of wax tree, copper and pheasant skin from Nagasaki, Japan. J. Begg donated specimens of cones of *Pinus aristatus.* Mr. Graham presented a specimen of "Loco" poison (*Oxytropis campestris*) from Bakersfield, S. P. R. R. From Mr. Zellerbach, quicksilver ore from Lake County. J. P. Moore presented specimens of ore from various localities. J. G. Riley presented specimens of ore from Lake County. Specimen of *Picea religiosa*, from volcano of Colima, Mexico, from J. Roegel. A. J. Dennison presented piece of chestnut or ash wood found embedded in piece of quartz from depth of 230 feet from surface, in Lee mine, Elko County, Nevada, on C. P. R. R., Palisade, 472 miles from San Francisco.

Henry Edwards submitted the following:

Pacific Coast Lepidoptera.—No. 12. On some New Species of Noctuidæ.

BY HENRY EDWARDS.

The species of moths described in this paper belong to the group *Anartidæ*, many interesting forms of which have been recently figured by Mr. Grote, in the Bulletin of the Academy of Sciences of Buffalo. Their extreme rarity in collections has always rendered them a favorite division of the family, and more than one of the genera now noted would appear to be confined to the Pacific States and Territories. The genus *Annaphila*, recently founded by Mr. Grote upon a Californian species, *Ann. diva.*, is remarkable for the lightness of the color of the lower wings, the system of coloration much resembling that of the genus *Catocala*. The insects fly in the hottest sunshine, and with the greatest rapidity, alighting only occasionally, when the harmony of color existing between the upper wings and the lichen-covered rocks or trees to which they attach themselves, renders them almost invisible. They are, therefore, very difficult of capture, and can really only be taken while on the wing, the process requiring a sharp eye and a steady hand. Nothing whatever is known of their larval condition. *A. diva*, *A. depicta*, and *A. amicula* are the most common of the group, the remainder being only found in my own collection or in that of my friend Dr. Behr, who has generously placed his unique species at my disposal for description. I have in all cases adopted his MS. specific names as applied to the specimens in his cabinet. The genus *Axenus* is found on flowers in the early spring, the species *Ax. arvalis*, on which Mr. Grote has founded the genus, being common in warm pastures throughout the State, as early as the first weeks in March. It is to be expected that diligent search, particularly in the southern portion of the State, will reveal many other species of these beautiful and interesting moths, and the attention of entomologists is earnestly directed to them.

Anarta Kelloggii, n. sp. Hy. Edwards.

Head, thorax and abdomen, black, with silver gray hairs.

Primaries, black, mottled with silver gray. The basal half line and the t. a. are indistinct, the latter only very slightly dentate; orbicular and reniform, very distinct, the former brownish, the latter surrounded by a white cloud. T. p., bent anteriorly after reaching the middle, distinct near internal margin, and edged outwardly with gray. Sub-terminal line whitish, tri-dentate, edged anteriorly with black shade, most strongly marked on the costa; marginal line black, cut with white streaks. Fringes blackish, mottled with gray.

Secondaries, black, with white median fascia, not reaching to anal margin. Fringes, white.

Beneath, both wings are largely white. Primaries, with the base and a broad sub-marginal fascia, dusky black. Secondaries, with base, small discal spot, and rather wide sub-marginal band, also dusky black.

Expanse of wings, 1.35 inches.

(Coll. Hy. Edwards, No. 5534.)

Taken in Tuolumne County, California, by Dr. A. Kellogg, to whom I am indebted for much valuable material, and to whom, with sincere regard, I dedicate this species. It is allied to *A. melanopa* of Labrador, but differs considerably by the more elaborate markings of the primaries, the much wider black margins of the secondaries, and the darker and more pronounced coloring of the under side.

Anarta crocea, n. sp. Hy. Edwards.

Primaries, grayish brown, speckled with black. Basal half line much bent inwardly at its conclusion. Between it and the t. a., the space is covered by mingled brown and white scales. T. a., which is gray, edged with black, runs obliquely from costa to beyond the middle, then forms a double tooth as it reaches the internal margin; orbicular and reniform, white, well defined; median space darkest towards internal margin. T. p., white, with anterior edge blackish, rounded from costa, and almost lunate in form. Behind it are many white scales on a brownish ground, most strongly marked on the costa. Subterm. consisting of a blackish shade, approaching the t. p. by a series of black dots. Fringe, gray, mottled with black. Thorax and abdomen, light gray, sprinkled with black.

Secondaries, yellow orange at base, with rather wide black margin. Fringes white.

Beneath, the wings are yellow orange, the lower side the darkest, with rather wide black margin, the costa of each sprinkled with brownish scales.

Expanse of wings, 0.85 inch.

Dalles, Oregon. (Coll. Hy. Edwards.)

It is possible that this species may form the type of a new genus, though the similarity of its system of coloration to the European *A. myrtilli*, induces me to place it here.

Meliclepiria venusta, n. sp. Hy. Edwards.

Head and thorax, rich chocolate brown; abdomen, black, with the anal hairs golden brown.

Primaries, with the base and outer margin rich chocolate brown. T. a., deeply notched anteriorly in the center. T. p., with a tooth extending outwardly, the space between these lines being cream white, except on the costa, where there is a light brown spot. Orbic., obsolete. Reniform, distinct, ovate, dusky. Fringes, brown.

Secondaries, blackish brown, with large white patch occupying the whole of the center of the wing, but not reaching to the anal margin. In this space near the base are some black scales. Fringes, white.

Beneath, primaries largely white, with costa and base broadly blackish, and a very large and distinct black discal spot. Margins, blackish, widely so at apex. Secondaries, same as the upper side.

Expanse of wings, 1.05 inch.

(Coll. Hy. Edwards.) Kalamath Lake, Oregon. Lord Walsingham.

A most exquisite and remarkable species.

Melicleptria vacciniæ, n. sp. Hy. Edwards.

Anarta vacciniæ. Behr. MSS.

Head and thorax, brown, with a few brown scales; abdomen, blackish brown, with the base of segments whitish.

Primaries, light brown, with a golden tinge; base of the wing darker than the other portion. T. a., only moderately curved, very slightly dentate anteriorly as it reaches the internal margin. Median shade, whitish, brown as it reaches the costa. Orbicular, almost obsolete. Reniform, large, distinct. T. p., whitish, bent considerably outwards near costa, nearly straight towards internal margin. Sub-term., sharply toothed in the middle; resting upon this line are four or five black dashes. Fringes, shining golden brown, with darker patches.

Secondaries, black, with median white fascia, broadest behind the middle, but not reaching to the anal margin. Near the outer margin is a small white streak, suggesting a sub-marginal band. Fringes, white.

Beneath, primaries black, reddish near costa, with broad median band, a kidney-shaped spot near apex, and anteriorly notched marginal band, all cream white. Secondaries, black, with a large space near the costa, reddish white, and a nearly oblong spot in center of wing, cream white. Behind this is also a small white spot. Fringes of both wings as in the upper side.

Expanse of wings, 0.75.

(Coll. Dr. H. Behr.) Sierra Nevada, Cal.

Melicleptria fasciata, n. sp. Hy. Edwards.

Primaries, fawn drab. Between t. a. and base, a slightly darker streak extends along the internal margin, and more slightly along the median nervule. T. a., almost obsolete. Median space, whitish, forming with white fascia of secondaries an almost continuous band. Orbicular and reniform, white, distinct. T. p., blackish, commencing very near the apex, then slightly bent inward, and straight as it reaches the outer margin; behind it a dark externally toothed shade. Margin, whitish, with fringe a little darker.

Secondaries, black, with rather narrow white median fascia, toothed in the center, and not reaching the anal margin. Fringe, white.

Beneath, primaries largely whitish, with a streak from base almost to center of wing, and a large irregular blotch on apical margin, black, leaving the interior margin, a large portion of costa, and the apex, white. Along costa of both wings are a few reddish scales.

Expanse of wings, 0.80.

(Coll. Hy. Edwards, No. 203.) Placer Co., Cal.

Very nearly allied to *M. vacciniæ*, of which it may possibly be the other sex; but the differences of the under side are very striking, and while the base of the primaries is almost black in *vacciniæ*, in the present species it is dark fawn drab. The t. a. and t. p. lines are also much straighter than in the preceding species, and the median shade, with white fascia of secondaries, form a much more continuous line.

Melicleptria oregonica, n. sp. Hy. Edwards.

Anthœcia oregonica. Behr. MSS.

Head, thorax, and abdomen blackish, with gray hairs.

Primaries, chestnut brown, with golden reflection. As in *M. suetus*, Grote, the traces of the ordinary lines are lost. The base is dark, almost black, with the orbicular white and well defined. Beyond the middle and inclosing the reniform is a white band, bent inwardly, indistinct on costa, and not reaching to the internal margin. Sub-term., nearly straight, whitish.

Secondaries, blackish brown, with rather broad white median fascia, which is interrupted and almost divided near anal angle. Near exterior margin is also a white oblong spot. Fringe, whitish.

Beneath, primaries, white, with two nearly square spots in center, a line resting on the anterior one directed towards the base, and an almost regular sub-marginal band, brownish black. Secondaries, also white, a large kidney-shaped discal spot, and a marginal band reaching from base beyond anal angle, blackish.

Expanse of wings, 1.00 inch.

Coll. Dr. Behr. (Hy. Edwards, No. 4405.) Oregon. Colorado.

Heliothis Crotchii, n. sp. Hy. Edwards.

Fawn drab, with blackish brown markings. T. a., much toothed exteriorly near internal margin. Median shade, pale. Orbicular and reniform, both distinct, the latter surrounded by a brownish cloud. T. p., commencing very near the apex, bending inwardly about the middle, thence almost straight to internal margin. Beyond this is a brownish, dentate fascia, the dentations formed by the sub-term. line. Marginal line composed of black dots. The whole of the nervules are pale and distinct, giving a reticulated appearance to the surface.

Secondaries, dusky, whitish towards the base, with clouded discal dusky spot.

Beneath, yellowish drab; primaries, with large discal spot, and some dashes near the base, blackish brown; margin, wide, dusky, with sub-terminal line

pale. Fringes, drab, mottled with brownish. Secondaries, yellowish drab, with oblong discal spot, marginal and sub-marginal band, dusky. Thorax and abdomen, yellowish, with darker scales, both paler beneath.

Expanse of wings, 1.00 inch.

(Coll. Hy. Edwards, No. 5533.) San Diego. G. R. Crotch.

Axenus ochraceus, n. sp. Hy. Edwards.

Very similar to *A. arvalis*, Grote, but differing by a large basal dark space, and by the t. a. being bent angularly forward on the costa, not nearly straight as in the more common species. The median shade is gray and well defined, contrasting very strongly with the rest of the wing surface, which is ochreous brown. The whole of the lines are more strongly marked than in *arvalis*. The secondaries are blackish at the base, with a decided ochreous band, enclosing a narrow black fascia. Fringes, yellowish. Beneath, ochreous, with same markings as those of the upper side, but much fainter in tone. The posterior wings have almost an orange tint. Size of *arvalis*, of which, should it prove to be a variety, it is certainly a very extreme one.

San Diego. G. R. Crotch. (1 ♀. Coll. Hy. Edwards, No. 5535.)

Axenus amplus, n. sp. Hy. Edwards.

A very distinct and peculiar species, in which the wings are much broader and more rounded than in *arvalis*, and the lines and spots, with the exception of the sub-term., utterly obliterated. The color is greenish olive, with a few white scales sparsely scattered over the whole surface of primaries. Sub-term. line, whitish, much curved inwardly as it reaches the internal margin. Secondaries, with faint discal dot, a few scales, and an imperfect sub-marginal band, whitish. Fringes of both wings, white. Beneath, greenish drab, the primaries darkest, discal spot paler, large, reaching almost to costa. The secondaries have the base dusky, with three more or less perfect dusky fascia. The margins of both wings are black, and the fringes greenish drab.

Expanse of wings, 0.80 inch.

Lake Klamath. Oregon. Lord Walsingham, by whom a ♂ and ♀ were kindly added to my collection.

Annaphila arvalis, n. sp. Hy. Edwards.

Erastria arvalis. Behr. MSS.

Primaries, dull, grayish black, with all the lines exceedingly indistinct. The t. a. black, only slightly notched exteriorly, and edged posteriorly with whitish. Median shade, blackish, with a few whitish scales beyond. Reniform, almost lost in the gray scales surrounding it. Fringes, blackish, flecked with white.

Secondaries, pale yellow, with a dull black basal triangular patch, enclosing some yellow spaces Margin, very narrow, even narrower than in *A. depicta*, Grote, and almost regular interiorly.

Beneath, both wings are yellow. Primaries, with broad black margin, widest at apex, and a narrow black transverse fascia, slightly bent outwardly

near anterior margin. Secondaries, with narrow marginal band as in the upper side, and narrow waved median band, behind which is a black discal spot.

Expanse of wings, ♂ 0.90. ♀ 1.05.

The largest of the species of the genus known to me.

Sierra Nevada, Cal. (♂ ♀. Coll. Dr. Behr.)

This is in some respects intermediate between *A. depicta*, Grote, and *A. danistica*, Grote, but differs from the former by its pale color, and by the absence of the discal spot of secondaries above, as well as by its larger size, and from the latter by the very different ornamentation of the under side.

Annaphila lithosina, n. sp. Hy. Edwards.

Erastria lithosina. Behr. MSS.

Primaries, dark fawn-color, with the markings all rich velvety black. Basal half-line more distinct than usual in this genus, and inclosing posteriorly a few white scales. T. a., very deeply dentate outwardly in the middle. Median shade, blackish, with a few bluish scales, especially around the orbicular, which is dark fawn-color. T. p., also dentate exteriorly, becoming almost straight as it reaches the margin. Outside the t. p. is a large, ovate, pure white spot, nearly reaching the costa. Reniform, obsolete. Beyond this, there is a bright fawn-colored shade, spreading from costa to internal margin, and joining the sub-term. line, which is blackish, terminating on costa in a white dash, and surrounded at apical angle by a few bluish scales.

Secondaries, bright orange; margin rather broad, deep black, widest towards costa, and deeply toothed internally. Basal space, blackish, with imperfect orange blotches, and a small black spot near anal angle.

Beneath, primaries, bright orange; transverse fascia, broad and nearly straight, black patch at the margin inclosing some yellow spots. Secondaries, margin as in the upper side, with a waved, broken fascia near the base. There is also a minute black spot resting on the costa.

Expanse of wings, 0.90 inch.

Sierra Nevada, Cal. (Coll. Dr. H. Behr.)

Dr. Behr informs me that this exquisite species is taken on the flowers of *Sambucus*. I saw a single specimen during the past summer at the Big Trees, Calaveras Co., which was hovering about the flowers of Dogwood (*Cornus Nuttallii*).

Annaphila amicula, n. sp. Hy. Edwards.

Primaries, blackish, with gray lustre. T. a., bi-dentate near the interior margin. Orbic., small, round, grayish. T. p., nearly straight, with only one tooth near the middle. Reniform, large, almost lost in the gray color which clothes the outer portion of the wing. Sub-term., velvety black, not reaching more than half way across the wing, divided on costa, and then inclosing some white scales. Marginal line, divided into a series of dots. Fringes, grayish.

Secondaries, bright orange, base black, extending along the anal margin, where the black line is slightly cut by an orange streak. Marginal band, rather narrow, but wider than in *A. depicta*, and only slightly notched interiorly. The discal spot is large, and a narrow black fascia. bent outwardly near the middle, extending across the wing.

Beneath, primaries, bright orange, shading into yellow on internal margin, a narrow transverse fascia, perfectly straight, and a large oblong discal spot, black. The margin broadly blackish, with yellow scales, widest at apex, and extending along costa, almost to the extremity of the transverse line. Secondaries, orange, with median transverse fascia, toothed near anal angle, and an oblong discal spot behind it, black. Between this and the marginal band are a few spots, suggesting the idea of a submarginal fascia. Margin, blackish, flecked with orange scales.

Expanse of wings, ♂ 0.60. ♀ 0.75.

San Mateo Co., Cal. (Coll. Hy. Edwards, No. 2587.)

Annaphila germana, n. sp. (?) Hy. Edwards.

Probably only a variety of the preceding. The primaries are exactly like those of *amicula*, except that all the lines and marks are more distinct, and the gray shade beyond the t. p. lighter in color and more strongly marked. The secondaries are bright orange, but have no median fascia, and the base is wholly black, while the marginal band is much wider than in the last species, and less deeply toothed interiorly. Beneath, there is little difference, except that the spots and lines are rather less strongly marked.

Expanse of wings, 0.75 inch.

Napa Co., Cal. (1 ♀. Coll. Hy. Edwards, No. 4379.)

Annaphila domina, n. sp. Hy. Edwards.

Primaries, darker than in any other known species, being deep black, with shadings of gray. All the lines, except the basal half, distinctly marked. T. a. almost straight, or with only a very small dentation in the middle. Orbic. and reniform, distinct, velvety black, the latter almost oblong. Across the median shade is a small patch of white scales, and a larger one outward of the t. p., which is arched on costa, dentate inwardly near the middle, and then continued straight to internal margin. Sub-term. almost wanting, the posterior margin of wings being dull slate-black, with no distinct markings. Fringes, also slate-black.

Secondaries, rich dark orange, with moderately wide border, only slightly notched internally, and extending all round the wing to the base, with an oblong discal spot, black. Fringe, black.

Beneath, the primaries are marked with the same system of coloration as those of *A. danistica*, but the orange is very much darker and richer in shade. The discal spots are three in number, each circled with orange. Beyond them is a transverse arcuate line joining another, extending along internal margin to base of wing. Margin, dusky black, apices broadly so. Secondaries, orange, with some scattered black scales along costa, and a black marginal band of moderate width extending to the base, speckled with white scales.

Discal spots small, almost linear. Tarsi and under side of abdomen with greenish and golden scales.

Expanse of wings, 0.75 inch.

San Mateo Co., Cal. (♀. Coll. Hy. Edwards, No. 5720.)

Annaphila superba, n. sp. Hy. Edwards.

Head, thorax, and abdomen, brownish black, sprinkled with gray scales.

Primaries, also blackish, with gray scales. The whole of the lines rather indistinct. Median shade, dark, with whitish scales. Orbic., obsolete. Reniform, blackish, surrounded by white ring. T. p., whitish, bent outwardly near the middle. Beyond this are some white scales, forming an imperfect fascia. Sub-term., black, not reaching internal angle, and between it and the margin are a few more white scales.

Secondaries, bright crimson red, margin of medium width, black, quite regular, and not toothed in any portion.

Beneath, both wings orange-red, shading into yellow, and surrounded by rather broad black margin. Primaries, with discal spot, and faint submedian fascia, black. Secondaries, with discal spot, and faint transverse line near the base, also black. Fringes, above and below, grayish.

Expanse of wings, ♂ 0.55. ♀ 0.70 inch.

Marin and Napa Counties, Cal. (Coll. Hy. Edwards, No. 4381.)

A very beautiful species, not to be confounded with any other, the bright crimson of the lower wings (as rich as in those of *Catocala cara*) and the regular black margin serving to distinguish it.

LIST OF SPECIES DESCRIBED IN THIS PAPER.

Anarta Kelloggii, n. sp. .... Sierra Nevada, Cal.
" *crocea*, n. sp .... Dalles, Oregon.
Melicleptria venusta, n. sp .... Klamath Lake, Oregon.
" *vacciniæ*, n. sp .... Sierra Nevada, Cal.
" *fasciata*, n. sp .... Placer County, Cal.
" *oregonica*, n. sp .... Oregon—Colorado.
Heliothis Crotchii, n. sp .... San Diego.
Axenus ochraceus, n. sp .... San Diego.
" *amplus*, n. sp .... Dalles, Oregon.
Annaphila nivalis, n. sp .... Sierra Nevada, Cal.
" *lithosina*, n. sp .... Sierra Nevada, Cal.
" *amicula*, n. sp .... San Mateo County, Cal.
" *germana*, n. sp. (?) .... Napa County, Cal.
" *domina*, n. sp .... San Mateo County, Cal.
" *superba*, n. sp .... Napa and Marin Counties, Cal.

Dr. Kellogg described a new plant, as follows:

Lilium Maritimum.

BY DR. A. KELLOGG.

Lilium maritimum. Kellogg.

Leaves alternate or rarely verticillate, chiefly clustered near the base, narrowly oblong-oblanceolate, subobtuse, narrowing into a short petiole, 3-nerved (intermediate or secondary nerves obscure), margins scarcely a little scabrulose, quite glabrous throughout, upper cauline successively diminishing to minute linear-lanceolate sessile leaves, barely ¼ of an inch. Peduncles elongated, terminal. Flowers few (1-3), somewhat nodding, short, or equilaterally obconic-campanulate; segments lanceolate, slightly revolute above the middle; genitals included, about equal; style short, straight.

Deep reddish orange-brown, inside dark purple spotted.

A small maritime lily found in the black, peaty, low meadows exposed to the bleak, foggy climate of the coast of California, in the vicinity of San Francisco. A lily not liable to be mistaken for *L. parvum*, K., or any depauperate form of *L. pardalinum*, K., as both of these have rhizomatic scaly bulbs, creeping, as it were, or spreading laterally into zigzag mats or masses, if the soil be rich or moisture favorable. Like the Oregon lily, this has isolated bulbs—both too hastily considered as varieties of *L. canadense*, like many others. This elastic species, for a lily hobby, is almost equal to any emergency; in the realm of speculative philosophy, this may have been truly the progenitor. From *L. canadense*, its nearest kin, it differs essentially in the genitals being included; a point not only of specific but generic importance. Flowers small, scarcely more than an inch in expansion, and of similar depth—giving it a truly equilateral obconic cavity, much more shortened and shallow-shaped. Style even shorter than the stamens. The perianth never pendent when in flower, but half erect, and looking outwards. Stem in general the smallest known—12 to 18 inches high, etc. I do not insist upon the absolute or relative form of the leaf being always narrower, although for the most part this is so; and very seldom do we see more than a single whorl, although cultivated remote from the coast, in light sandy soils; the leaves then may become broader, somewhat oblanceolate, acute, and sessile, but never pubescent along the veins. Salt margins of our sea-coast do certainly modify the forms of plants; yet, with all due allowance, the entire physiognomy is not so changed as we witness here.

In general, the bulb is pure white, strictly conic, scales closely pressed, 1 to 1½ inches in diameter; leaves 1 to 5 inches long, ¼ to ½ inch wide, rarely verticillate. Flowers May to August. Capsules long, narrow, not winged. The late lamented H. G. Bloomer, Botanical Curator, has long ago recorded his protest against this being considered a variety of *L. canadense*.

Dr. Gibbons made some verbal remarks on clouds.

Dr. C. F. Winslow, a former member of the Academy, being present communicated for record the following statement in order that investigations might be made upon the subject when opportunity might occur hereafter.

In 1853, in passing a barber's shop on Kearny Street, he saw a fragment of a large bone, appearing to be a portion of a tibia of some gigantic quadruped or reptile. He purchased it and still has it in possession, stored at Boston with his collections. He sent it to Professor Leidy several years after obtaining it, and the Professor pronounced it to belong to a gigantic sloth of an extinct and undetermined form. He sent it also to Professor Baird of the Smithsonian Institute, that a cast of it in plaster might be taken for preservation in case of loss of the original. This fragment was in an excellent state of preservation. The history of its discovery and location is this:

When workmen were engaged in digging a well, about the year 1852, where Dr. Frederick Zeile's Baths are now located, (that is, in the rear of 524–528 Pacific Street, San Francisco,) at the depth of about 23 feet they struck a hard whitish object, which on being thrown out was discovered to be the leg bone of some large animal. It was broken into several pieces, and the barber secured this fragment which he preserved, and for which he wanted a big price. The Doctor succeeded in getting it for three dollars. He then found one of the men who had been employed to dig the well, and was informed by him that the excavation went through one of the limbs of the skeleton, and that the whole of the rest of it was still embedded in the yellow silt through which they dug till they came to water. The workman judged the depth at which the skeleton laid to be about 23 feet below the surface.

When Dr. Zeile's brick building was put up, Doctor Winslow observed that the rear wall just embraced the well within its area; and he has always considered it possible to reach the skeleton without injury to the edifice, by careful excavation.

This gigantic fossil is probably entirely new to Science, and would be of great value to the collections of the Academy.

The Doctor hoped efforts might be made to explore this spot and obtain the bones. If the rest of the skeleton was as well preserved as the fragment he has, it could be easily and safely put together, and would be a priceless acquisition to the museum.

Regular Meeting, June 22, 1875.

Vice-President Gibbons in the Chair.

Twenty-four members present.

Donations to the Museum: Hon. F. Berton, Swiss Consul, presented a bronze medal cast in honor of Agassiz.

Dr. Wm. Gibbons, of Alameda, read a description of a new species of trout from Mendocino County, as follows:

Description of a New Species of Trout from Mendocino County.

[Typical specimen in the Collection of California Academy of Natural Sciences.]

BY W. P. GIBBONS, ALAMEDA.

Salmo mendocinensis. Gibbons.

Body stout; outline from the nape of the neck to the snout, somewhat incurved; dorsal outline, but slightly arched; tail, truncated; head, medium size; from the anterior margin of the dorsal to the snout, nine-tenths of an inch less than from the same point to the insertion of the tail. Teeth numerous, moderately stout, incurved, fifteen to twenty on each maxillary; nine stout incurved teeth on each pre-maxillary; two double teeth on the knob of the vomer, four on the shaft; palatal teeth recurved, thirteen on each side; five teeth on each edge of the tongue; about thirteen on each side of the lower maxillary. The end of the lower jaw projecting about half an inch beyond the obtusely rounded snout, which receives in a notch its knobbed extremity. Center of the eye on a line drawn from the extremity of the snout to the end of the lateral line.

Br. 12–13, D. 12, P. 13, V. 10, A. 13, C. $\frac{1}{8}$.

Vertical line from the posterior extremity of the upper maxillary, four-tenths of an inch behind the posterior edge of the iris.

Adipose and anal opposite; ventral terminates under the middle of the dorsal. No spots on A., V., or P. Dorsal and adipose with oval dark spots.

From tip of snout to nape of neck, 4 inches.

Number of times contained in total length, 6.75.

From tip of snout to farthest point on free margin of operculum, 6 inches.

Number of times contained in total length, 4.5.

Total length, 27 inches.

From tip of snout—To anterior edge of iris, 2 inches.
" " To posterior edge of iris, 2.75 inches.
" " To extremity of superior maxillary, 2.63 inches.
" " To anterior base of dorsal, 10.75 inches.
" " To posterior base of dorsal, 14 inches.
" " To anterior base of adipose, 19.75 inches.
" " To base of tail along lateral line, 24.50 inches.
" " To base of tail, superior, 22.25 inches.
" " To base of tail, inferior, 22.75 inches.
" " To anterior base of anal, 17.50 inches.
" " To anterior base of ventral, 12.50 inches.

Greatest depth of body, 6.5 inches.

Color above lateral line when first taken from the water, cupreous iridescent, gradually blending to silver-white along the belly; the colors soon fade to gray.

The typical specimen from which this description is taken is a male of 7.5 lbs. weight. The average weight of the fish is about 12 lbs. The largest that has ever been caught weighed 28.5 lbs.; the smallest that come to spawn, 4 lbs. The color of the male is darker than that of the female. The male has very few spots, while the female is covered with them, except the belly: the spots along the sides are larger than the others. When first caught, the females are of a bright silver color; hence, some call them "silver salmon." The flesh of some is nearly white; of others, yellow or salmon-color. The males are deeper from back to belly, and thinner, than the females.

The spawning season commences usually the latter part of March, and lasts about a month. The hookbill goes from the first to the last of January; the Sacramento salmon, from the middle of January to the middle of February. Both invariably depart before this fish commences to spawn. They come up in pairs, and select different kinds of locations from the hookbill and the Sacramento salmon. They will take a fine ripple caused by a large rock or by tightly packed gravel, about which there is always some dead water. After brushing away the sediment, if any has accumulated, they lay their eggs, well distributed, seldom more than two or three clusters touching. They never cover their eggs with sand, as some fish do; nor do they dig holes, as the hookbill; nor select holes among large rocks, as the large salmon occasionally does. The period of incubation is not known. When hatched, the little fish must work down stream, as none are found in the rivers save those which are between half a pound and three pounds in weight. Like salmon, they must go to the sea and mature; though this voyage is not absolutely necessary, as some remain during the entire year, when the streams, drying up, prevent them from passing down; but, generally, they seem to depart before the water falls so low. Those caught in the fall, which have remained during the summer, are generally in as good condition as those which appear in the spring. They eat small fish and frogs, when in the spawning-beds. It seems to make no difference how large the fish may be, as to their stopping in fresh water. They are very sagacious about the time and place of depositing their spawn, when there are no large fish to prey upon them; nor do they lay them in such localities as the water may subside and leave them exposed.

Still they have numerous enemies, among which is a small trout which returns to the main streams in April, having either gone to smaller and clearer streams in winter, or hidden themselves; for I have never been able to find them in the main creeks during the winter. There is also a species of diver, mostly white, and larger than a wood-duck, which lives almost exclusively on the eggs during the season. This fish comes up all the streams that empty into the coast near this place.

I am indebted to Mr. Joseph H. Clarke, a corresponding member of the Academy, for the foregoing intelligent description of the character and habits of this trout. It has been a subject of careful observation with him for the past two or three years. The Academy is under furthur obligations to him for sending several specimens, which have formed the basis of the description of this species. It would afford me pleasure to recognize Mr. Clarke's contribution to science by giving his name to this fish; but there is already a *S. Clarkii*, described by Richardson.

Dr. Kellogg described a new species of Lily, as follows:

Lilium Lucidum.

BY DR. A. KELLOGG.

Lilium lucidum—Kellogg.—Leaves whorled, scattered below and above, lanceolate, or ovate lanceolate, very short petioled, or subsessile, pseudo-triplinerved or somewhat 3-nerved, smooth throughout, short peduncled. Flowers few (or 1—6), nodding, sepals sessile, lance-acute, strongly turbinate-revolute, thickened at the base, genitals exserted, about equal; style straight, thick, light translucent yellow-orange, the dark purple spots on the inside visible from without. June to August.

Bulb spheriod, or slightly depressed oblate-spheroid; scales thickened lanceolate, acute, strongly incurved and very closely appressed; whitish, with yellowish-greenish tinge, 1½—2 inches in diameter; isolated; perennial; stem more central, 2 to 3 feet high, quite glabrous throughout; shortish thick peduncles from axils of bractoid leaves; lower and larger leaves 1—1¼ inches wide, about 3—4 inches long, diminishing above; flowers 1½ inches expansion, 1 inch deep; style, ½—¾ inch long.

A lily from Oregon and Washington Territory, long known, but also considered by authorities as another variety of *L. Canadense*. Without recapitulating the isolated and peculiar perennial bulb, position of stem, form and color of flower, surface, equal genitals, etc., we take these to be constant characters. Indeed, the very revolute sessile sepals remind us more of *L. Superbum* than *Canadense*, while the smaller, closer flowers and thickened base are peculiar. These points were distinctly discussed and shown to the Academy about fifteen years ago, when this same painting, accompanied by specimens, was on exhibition; and our opinion then given as to its being a distinct species. Having no bulb in hand at the time to verify statements or complete the manuscript, it was held in abeyance, we believe, although the description was then written.

Judge Hastings read three papers on the following subjects: "On the Genuineness of Archæological specimens, including Ancient Coins;" "A Plan for the Construction of Levees for reclaiming land;" "San Francisco as a point for an Astronomical Observatory."

Amos Bowman read a paper on "The Geological Formation of California."

REGULAR MEETING, JULY 6TH, 1875.

President and Vice-Presidents being absent, R. E. C. Stearns was called to the Chair.

Owing to a misapprehension on account of the night of meeting, only six members were present, and the meeting adjourned without transacting any business.

REGULAR MEETING, JULY 19TH, 1875.

Vice-President Gibbons in the Chair.

Twenty-three members present.

Donations to the Museum: Duplicate fossils, "Types of Dana's exploring expedition to Australia and Japan." From Henry Edwards, specimens of *chœtiles crenita*, *spirifer glaber* and *Platychisma occulis* from Australia; also specimens from the miocene, Oregon, *cleobis grandis*, (N. S. Wales,) *Pleurotomaria Morrisiana*, (N. Z.), lignite from Astoria, Oregon; Crustacean from the Bay of San Francisco. From W. Sublette, *Chimœra Calliniensis*. From W. A. Woodward, galena ore from Searsville, San Mateo County. Quicksilver ore with garnets, Sonoma County, from

R. R. Craig. Samples of *Annatidæ* found floating in the Pacific by the donor, Dr. O. M. Wozencraft. Five birds from F. Gruber. *Fontinalis antipyritica* from Ireland, from Dr. R. K. Nuttall. Specimens of ore from R. R. Craig; also ores from O. P. Callaway.

The following paper by Henry Edwards was read by the Secretary:

Pacific Coast Lepidoptera.—No. 13. On the Earlier Stages of Vanessa Californica.

BY HENRY EDWARDS.

In a very interesting and valuable article by Dr. H. Behr, on the "Vanessidæ of California," published in the third volume of this Society's Proceedings, reference is made to the large swarms of *Vanessa Californica* observed some years ago in the neighborbood of San Francisco, and the simultaneous occurrence in various parts of the State of this insect, which, in ordinary years, cannot be otherwise regarded than as one of our rarer species. By a fortunate circumstance, I am enabled to add a few facts to the natural history of this butterfly, and at the same time to present a description of its earlier stages, which have been hitherto unrecorded. In an excursion up the cañon at the head of Richardson's Bay, at the base of Mount Tamalpais, on the 9th of May last, I observed, soon after leaving the open fields and passing into the more secluded portion of the gulch, myriads of caterpillars on every side, swarming on the ground and on every blade of grass. A further and closer search disclosed the fact that the bushes of *Ceanothus thyrsiflorus*, which here attain a large size, sometimes reaching as great a height as twelve or fifteen feet, were utterly stripped of their leaves, looking as if some pestilence had passed over them, and destroyed every vestige of their flowers and foliage. It was not difficult to divine that this denudation was owing to the multitudes of caterpillars which had made their home upon the plants, on which they were to be found in nearly all the stages from about the third moult to full grown larvæ. It is not too much to say that they could be counted in millions, for, in following the creek, which runs through the cañon, for upwards of a mile, I found the *ceanothus* growing abundantly, and the same circumstance of the immense numbers of the insect, and consequent destruction of the foliage of the plant, everywhere displayed themselves. The eggs of the parent insect appear to have been deposited in clusters, as I noticed upon the extremities of many of the branches small webs in which the cast skins of the young larvæ were very abundant, thus suggesting the idea that in their earlier stages the caterpillars are gregarious, not separating from their common home until about the period of the third moult. I found several of these skins sufficiently perfect to enable me to offer a fair comparison of the young larvæ with their appearance in the more advanced stage in which they came immediately under my observation. I sought carefully for any *Ichneumonidæ*

or other parasitic insects which might be present, imagining that so large an assemblage of larvæ would prove for them a certain attraction, but I did not succeed in taking a single specimen, nor as yet have any appeared among the caterpillars which I brought home with me. I have, however, observed in my breeding boxes four examples of a rather large dipterous parasite, probably of the genus *Tachina*. As, however, I carried away with me nearly ninety caterpillars, all of which passed successfully into the chrysalis state, this is but a very small proportion to be affected with parasitic enemies. Is it possible that this comparative immunity is owing to the sharp and formidable looking spines with which the caterpillars are furnished? Certain it is that the *Vanessæ* generally are more exempt from the attacks of Ichneumons than most other butterflies.

During the last summer, the young lupines in the Golden Gate Park were attacked by myriads of caterpillars, which at one time threatened their destruction, but the preservation of the small birds in and about the park kept down the swarm, and a succession of very cold winds, during the middle period of their growth, killed them off in thousands. I raised from the caterpillars, of which I took away with me upwards of a hundred, no less than eighty-five specimens of *Pyrameis Cardui* and *Pyrameis Huntera*, and not a single one among them was observed by me to be attacked by parasites. This, in conjunction with the facts noted above, with reference to *Vanessa Californica*, would seem to indicate that these insects enjoy a freedom from the assaults of their tiny foes, which is not granted to other members of their tribe. It may partially account for the vast swarms of the various species which periodically make their appearance in different parts of the world. But this is one of those singular occurrences connected with insect life, which are so difficult to explain satisfactorily. The cañon in which *Vanessa Californica* was found has been visited by J. Behrens and myself at least twice every season for the last six years, and though I have invariably sought most diligently for caterpillars, until now that of the present species has been utterly unknown to me.

It may with almost certainty be predicted that the coming fall will witness the same large swarms of this butterfly as those observed by Dr. Behr in 1856 and 1866, which dates will serve to indicate that the insect appears in such numbers about once in nine or ten years. The caterpillars collected by me fed voraciously, and changed into the chrysalis state from the eleventh to the twenty-fourth of the month, the transformation of all I had secured being complete by the latter date. In this condition, they were extremely restless, constantly keeping up a jerking motion, and knocking themselves against the lid and sides of the boxes in which they were placed, with such force as to be heard all over the house. On the 23d of May, my friend Samuel Williams, of the *Evening Bulletin*, was enjoying a picnic in the cañon mentioned above, when the attention of his party was drawn to a very singular noise in the bushes over their heads, the cause of which it was for a time difficult to discover. At last it was found to proceed from myriads of chrysalides, attached to the leafless stems of the *ceanothus*, which, by a constant motion of their bodies, gave a trembling to the branches of the shrub, and produced the singular and half weird noise referred to. The perfect insects began to appear on the 25th of May, and did not all emerge until the 6th of June, the average

time in the chrysalis state being about fourteen days. The young caterpillars are wholly jet black, with the spines shorter than they are towards maturity, and without any trace of the steel-blue, shining tubercles, which are so strong a characteristic of their more advanced stages.

After the third moult the following is the appearance of the caterpillar: Head, moderate, jet black, shiny, with two short branched spines on the crown, and a series of smaller ones on the sides in front. In the center of the head is a groove. Body, deep velvety black, each segment behind the head with five branched spines, at the base of which are bright, steel-blue tubercles. In the sunlight, these tubercles, from their highly polished surface, glisten almost like jewels. Between the spines, and particularly about the dorsal region, are a number of small white circular dots, from each of which springs a short whitish hair; and a rich black velvety line, sharply defined, extends from the base of the head to the anal segment. The latter is furnished with only two branched spines. Prolegs, black; abdominal legs, dirty yellow. Length, 1.00 inch.

Mature larva. There is no change except in size until the final moult, when the middle spine of each segment becomes bright yellow at the base, and the white spots at the base of the hairs larger and more numerous, giving the appearance of a yellow dorsal line. Length, 1.65 inch.

Chrysalis. General color, ashy gray, with bluish efflorescence; abdomen, fawn-color; head, with two rather sharp, well developed, blackish processes; thorax, mottled with brownish, with two angular spines near the junction of the wings; mesenotal process, rather large, brown, with sharply hooked spine directed backwards. On the sides of the thorax are four black points, the basal ones surrounded by a cream-white patch, which extends to the first abdominal segment. Wing covers, ashy, brown along the margins; basal abdominal segment, with two small, black spines, behind which are large cream-white patches. The remaining abdominal segments have each two black points surrounded with black patches, growing smaller and fainter towards the anal extremity. Spiracles, black, almost linear, with a series of black dots above and below. The anal segments are much arched, directed inwardly toward the exterior of the wings. Length, 0.65 inch. There is no trace of silver upon any part of the surface of the chrysalis.

As *Vanessa Californica* has been said by some authors to be identical with the European *polychloros*, I subjoin, for comparison, a brief description of the caterpillar and chrysalis of the latter species. It will at once be seen how widely separate the two are, in their earlier stages. *Vanessa polychloros, L.;* Caterpillar, bluish or brownish, with a lateral stripe of orange. The spines are slightly banded and yellowish. The larvæ feed on the willow and elm, and on some kinds of fruit trees, especially the cherry. *Encyclop. Method. Papillon.* 305. *Chrysalis*, flesh-colored, with golden spots near the neck.—*Ib.*

Since writing the above, yesterday (June 6th), in company with Mr. Behrens, I paid another visit to the cañon in which we had previously found the *Vanessa*. Contrary to my expectations, the insect was far from abundant, and at least 75 per cent. of those we found were crippled in the anterior wings, while dead specimens, which had never been able to take an extended flight, were scattered everywhere about our path. The females also seemed

to take refuge at the roots of the dried-up grass, abandoning themselves to death. Well developed specimens of both sexes flew rather rapidly, alighting very frequently, and settling on stems of trees and among decayed leaves closely resembling them in the color of the under side. They also invariably placed themselves upon the branches with the head downwards. The insects appeared to be confined to a very small area, as we did not meet with any specimens except in the immediate neighborhood of the spot in which the caterpillars were taken. The crippled state of most of the imagos may be owing to the extremely dry state of the weather during the past month, the want of moisture acting upon the wings of the insect during their last stage, and preventing their proper development.

S. C. Hastings read a paper on "Phenomenal Changes of Climate in Past Epochs."

Dr. Gibbons read an obituary notice of Marshall C. Hastings.

Regular Meeting, August 2, 1875.

Vice-President Edwards in the chair.

Thirty-five members present.

The following new members were elected: Dr. G. King, Dr. F. W. Godon, A. W. Crawford, Pembroke Murray, Wm. Eimbeck, Jas. L. King.

Donations to Museum: Fossil bone from Tanitos Creek, San Mateo County, California, W. S. Downing. Fossil shells from Pescadero, from Milo Hoadley. Fifteen species of *Unionidæ* from W. G. W. Harford. Textile plants from various localities, from Geo. W. Dent. Specimens of ores, from Joseph Potts, Coll Dean, R. H. Rogers, A. W. Von Schmidt and Geo. W. Dent. Woods, from A. W. Crawford.

Dr. Blake read the following paper:

On Roscoelite, or Vanadium Mica.

BY JAMES BLAKE, M. D.

At a meeting of the Academy in September of last year, I presented a specimen of a new mineral, under the name of Colomite, which I then considered to be a mica, containing a large percentage of chromium. I had, at that time, made no detailed analysis of the substance, and had merely arrived at the conclusion that it was a chrome mica, from some superficial blow-pipe tests, and from its reaction with acids; knowing, also, that chromium is not an uncommon ingredient in micas. Subsequent to my last communication on the subject, Dr. Ghent, of Philadelphia, to whom a specimen of the mineral had been sent, discovered that it contained vanadium, and on his informing me that such was the case, I sent him all the specimens of the mineral I possessed, so as to enable him to make a complete analysis of it.

I shall not now enter into its chemical composition, merely remarking that, as I before observed, it is evidently a potash mica, containing about twenty per cent. of vanadium, instead of chromium, as I had before stated. I expect Dr. Ghent will shortly publish his analysis of the mineral in the *American Journal of Sciences.*

The occurrence of a mineral containing so large a percentage of vanadium is interesting, as, up to the present time, vanadium has been found in but very few substances; it is, in fact, one of the rarest of the elements, and although it has lately been discovered in some volcanic rocks, yet it is present in such small quantities—not more than one part in ten thousand—that even its detection is difficult.*

The only chemist who has successfully investigated the properties of vanadium, is Professor Roscoe, of Manchester, and I propose to name the mineral, Roscoelite, as the most appropriate name I can give it.

As I stated on a former occasion, the mineral occurs, associated with quartz, in a vein in porphyritic rock, at Granite Creek, in Eldorado Co., in the lower hills of the Sierra. It has been extremely rich in gold, the mica carrying most of the gold. The substance is interesting. under a mineralogical point of view, as affording a unique instance of so large a proportion of a pentavalent element entering into the composition of a mica, and offers, perhaps, the most curious instance of the anomalies that present themselves in the chemical composition of this class of minerals.

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*I think it probable that vanadium may occur in larger quantities in these rocks than is supposed, as I believe the methods employed for separating it are imperfect. I have mixed vanadium with basalt, and after treating it in the manner indicated for separating the substance, I obtained but about 65 per cent. of the quantity added. I have reason to believe that it forms compounds with the alumina, iron, and silica of the rocks which have not been at all investigated. Since the above was written, I find that Dr. Hall has found vanadium widely diffused in many rocks, generally associated with phosphorous, although I have been unable to detect the presence of phosphorous in the mica.

Dr. Blake related the results of some physiological experiments he had performed, to determine the molecular relations of Beryllium. Neither the specific heat of the metal, or the vapor density of its chloride, had been ascertained, and chemists were undecided as to whether it was a trivalent or quadrivalent element. Its physiological reactions, when introduced directly into the blood, so closely resemble those of alumina, that there can be no doubt but that it belongs to the same isomorphous group, and that it is therefore quadrivalent. There is also a close relation between the intensity of the physiological action of the compounds of these two metals and their atomic weights. In a series of experiments, conducted expressly to determine this point, the quantities of Be_2O_3, under the form of sulphate, required to kill 2,270 grammes of rabbit, when injected into the veins in divided doses, were .059, .061, .050 grm; and of Al_2O_3, injected under the same conditions, were .021, .023, .022 grm. The smallest quantity required to arrest the vital reactions, when introduced in one dose, was of Be_2O_3, .038 grm; of Al_2O_3, .016 grm; showing a marked increase in the physiological action of these substances with the increase of their atomic weights. This, I believe, is the first time that physiological reactions have been used to throw light on the chemical properties of a substance. Should, however, the carbon compounds follow the same laws in their physiological reactions as the inorganic elements, living matter must offer a valuable reagent in their investigation. The recent experiments of Messrs. McKendrie and Dewar, published in the twenty-third volume of the Proceedings of the Royal Society, certainly indicate that such may be the case, as in experimenting with the compounds of the Chinaline and Pyridine groups, it was found that the physiological action became stronger in going from the lower to the higher members of the series. They also observed that, in the Pyridine group, where the base became doubled by condensation, not only was the physiological action more intense, but its character was completely altered, agreeing with the salts of iron, with which analogous changes take place, both in the character and intensity of their physiological action, when the molecule is doubled in the change from the ferrous to the ferric salts. [See "Journal of Anatomy and Physiology,' vol. 3, p. 24.]

Dr. Behr described a new weed from Lower California.

A paper by W. N. Lockington was read as follows:

List of Echinidæ now in the Collection of the California Academy of Natural Sciences, May, 1875.

BY W. N. LOCKINGTON.

Suborder DESMOSTICHA.

This suborder includes the regular sea-urchins, that is, those in which the poriferous zones are continuous from mouth to apex, both of which are central, the apex with ocular, genital, and anal plates.

Family CIDARIDÆ.

Interambulacral areas very wide, with few coronal plates, each bearing a single primary perforate tubercle, surrounded by a large scrobicular circle. Actinal and abactinal systems large. Ambulacral areas very narrow, composed of numerous small plates, the pores in single pairs, and the median ambulacral spaces set with small flattened papillæ. Jaws not so complicated as in the *Echinidæ* and *Diadematidæ*. Teeth in shape of a gauge. Auricles made up of independent arches, and taking their origin from the interambulacral spaces. The spines are large and solid.

CIDARIS.

1. *C. Thouarsii.* Valenciennes. Panama. Gulf of California.

Two large specimens from the latter locality, presented by D. E. Hungerford. This species attains a diameter of about two inches.

2. *C. metularia,* Blainville. Red Sea. Mauritius. East Indies. Sandwich Islands. Feejee Islands.

The specimens in the museum are from A. Garrett, and were collected in the Sandwich Islands. This is a very small species, the largest specimen not exceeding three-quarters of an inch in diameter.

Family ARBACIADÆ.

This small family contains *Echini* without secondary and miliary tubercles; with the pores in single pairs; jaws somewhat resembling those of the *Cidaridæ*, and the auricles disconnected. The spines are solid, but thinner than those of the *Cidaridæ*, and the anal system consists only of four large plates.

ARBACIA.

3. *A. stellata*, Gray. Gulf of California. Panama.

Family DIADEMATIDÆ.

Test thin, ambulacra narrow. Spines long, hollow, verticillate or transversely striated; tubercles of ambulacral and interambulacral areas similar. Auricles not forming connected arcs. Pores in arcs composed of three pairs.

DIADEMA.

4. *D. Mexicanum*. Acapulco. Cape St. Lucas.

5. *D. setosum*, Gray. Cape Verde Islands. Japan. Sandwich Islands. Feejee Islands.

A single specimen from the Bonin Islands, presented by W. J. Fisher.

ECHINOTHRIX.

6. *E. calamaris*, A. Agassiz. East India Islands. Society Islands. Philippines.

A single fine specimen, presented by W. J. Fisher, naturalist of the "Tuscarora," and dredged from a depth of ten fathoms, off the Bonin Islands. When first brought in, there was observable a singular swelling at the apex, which led me to suspect there might be a parasitic crustacean within; a supposition which was afterwards verified by the extraction of a fine specimen of a new species of the family *Pinnotheridæ*, measuring fully $1\frac{1}{8}$ in. across the legs. The family *Pinnotheridæ* are all parasitic, inhabiting the mantle of oysters, mussels, *Haliotis*, and other mollusks, and also, as in this instance, the extremity of the digestive canal of certain *Echini*.

Family ECHINOMETRADÆ.

This family contains many genera and species, all of them distinguished from the *Echinidæ* proper by having the pores arranged in arcs of more than three pairs. In many cases, the outline is a long oval, and the axis is oblique, that is, it does not coincide with the center of either ambulacral or interambulacral areas.

HETEROCENTROTAS.

7. *H. mammillatus*, Brandt. Zanzibar. Red Sea. East India Islands. Sandwich Islands. Feejee Islands. Gulf of California.

Alexander Agassiz, in his "Revision of the Echini," gives all these localities except the last; but we have in our collection unmistakable specimens of this fine species, brought to Prof. George Davidson from Cape St. Lucas.

The spines of *H. mammillatus* are very large, and vary in shape from that of a cricket-bat to that of a bayonet; and the test is very strong and thick.

8. *H. trigonarius*, Brandt. Mauritius. Java. Sandwich Islands. Feejee Islands.

Unfortunately, our only example of this species is a single denuded test, whereas of the foregoing we have three fine specimens; the arrangement of the tubercles in the abactinal part of the ambulacral region is, however, sufficient to establish its specific identity. The spines are usually triangular in section.

ECHINOMETRA.

9. *E. Van Brunti*, A. Ag. Peru. Panama. Gulf of California.

10. *E. lucunter*, Blainville. Zanzibar. Red Sea. East Indies. Japan. Sandwich and Feejee Islands.

Of this species we have three specimens, two of them from Japan, presented by W. J. Fisher.

11. *E. oblonga*, Blainville. Philippines. Seychelle Islands. Sandwich Islands.

STRONGYLOCENTROTUS.

12. *S. purpuratus*, A. Ag.

This species is abundant on this Coast between Puget Sound and San Francisco, but data are wanting to determine its range north and south of those points. It is eaten by the Italians. In color it is dark violet when alive, but the dried tests have a greenish tint.

13. *S. Franciscanus*, A. Ag.

This species is one of the largest of the Echinidæ, attaining a diameter of six inches across the test. It is found at various points upon the Pacific Coast, from Queen Charlotte's Island to San Diego, and A. Agassiz gives Formosa also as one of its localities.

14. *S. Mexicanus*, A. Ag.

Several specimens from the Gulf of California. The spines in this species are nearly as long as the diameter of the test; a peculiarity by which it may easily be distinguished from *S. purpuratus*.

15. *S. Drobachiensis*, A. Ag. North European Seas. North Pacific. N. E. Coast of North America.

This species is common to the more northern parts of both continents, and is found on both shores of this continent. It is, in fact, one of those animals which appear to have been driven in all directions from the pole, by the influence of increasing cold.

Our specimens, which are very fine and perfect, were presented by W. Jones, Esq., Surgeon U. S. N., and were dredged in 45 fathoms, about 6 miles off the shore of Marmot Island, Alaska, from a bottom of rock and sand.

16. *S. Intermedius*, A. Ag.

Two specimens in this collection appear to belong to this species, as they have the greenish spines and the small tubercles upon the anal system mentioned in the description by A. Agassiz; the locality, however, is different, as that author gives Japan, while these are from the Sandwich Islands.

Family ECHINIDÆ.

In this family the arcs of pores in the poriferous zone are never composed of more than three pairs. It is divided into two sub-families, the *Temnopleuridæ*, characterized by peculiar pits at the angles of the coronal plates, and the *Triplechinidæ*, which have short, straight arcs of three pairs of pores.

Sub-family TRIPLECHINIDÆ.

ECHINUS.

17. *E. Esculentus*, Linn. Norway. English Channel.

18. *E. Margaritaceus*, Lamk. Patagonia. California.

The specimen in this collection was dredged in 40 fathoms, at San Pedro, by W. J. Fisher.

19. *E. Norvegicus*. Norway. Mediterranean. Straits of Florida.

20. *E. Miliaris*. Norway. English Channel.

Genus TOXOPNEUSTES.

21. *T. Pileolus*, Agassiz. Panama. Gulf of California. Viti Island. Mauritius. East India Islands.

HIPPONOE.

22. *H. depressa*, A. Ag. Gulf of California.

23. *H. variegata*, A. Ag. Sandwich Islands. Japan. East India Island. Viti Island. Red Sea. Mozambique.

This species is smaller than *H. depressa*, from which it is easily distinguished by the small size of the tubercles, by the absence of tubercles in the interambulacral and median ambulacral spaces between the ambitus and the abactinal pole, and by the coloring (usually violet) of those spaces.

Sub-order CLYPEASTRIDÆ.

This sub-order, intermediate between the regular Echini and the *Petalostichæ*, contains Echinoids with very low, flat tests, petaloid ambulacra, and anal opening detached from the apical system, so as to give, as in the *Petalostichæ* or Spatangoids, an anterior and posterior extremity. They differ from the Spatangoids in the possession of jaws, which are, however, much simpler than in the regular Echini, and articulate upon the auricles of the test,

instead of being held in place by a system of muscles. On the lower or actinal surface ambulacral furrows, crowded with small pores, and arranged irregularly, take the place of ambulacra. The ambulacra of the upper or abactinal surface are broader than the interambulacra.

Family CLYPEASTRIDÆ.

Echini with supports connecting the upper and lower floors of the test, either as pillars, walls, or radiating partitions.

ECHINOCYAMUS.

24. *E. pusillus*, Gray. Norway. Mediterranean. Azores. Florida.

CLYPEASTER.

25. *C. rotundas*. Panama. Gulf of California. San Diego.

The fine specimen from the Gulf of California, in this collection, is of a dark violet tint, which is its color when alive.

26. *C. scutiformis*. Red Sea. Philippine Islands. Kingsmills. Japan.

It has been my good fortune to examine a large number of specimens from Japan and the Pacific islands, obtained by various persons, among them W. Garratt and W. J. Fisher. These specimens, which are $1\frac{3}{8}$ to above 4 inches in length, all evidently belong to one species, and that species a *Clypeaster*, and not an *Echinanthus*, since there are no double floors or double walls. As the small specimens agree exactly with the *C. scutiformis* of Samk., it is evident that the larger ones are the adults of that species.

The three specimens in the collection measure respectively $1\frac{3}{8}$, $2\frac{5}{16}$, and $3\frac{15}{16}$ inches in longitudinal diameter, and $1\frac{3}{16}$, $1\frac{7}{8}$, and $3\frac{1}{4}$ inches in transverse diameter; but I have seen specimens exceeding the largest of these.

Family LAGANIDÆ.

Floors of test connected by walls running parallel to the edge; interambulacra extremely narrow.

LAGANUM.

27. *L. depressum*, Sess. Kingsmills. Viti Island. Philippines. Australia. Zanzibar.

Two small specimens, one of which measures $1\frac{3}{4}$ inch longitudinal diameter by $1\frac{1}{2}$ inch transverse diameter, appear to be the young of this species. They are from the Kingsmills. The partitions, forming a narrow belt of three or four concentric walls near the edge of the test, agree with *Laganum* proper, not with *Peronella*.

Family SCUTELLIDÆ.

Test extremely flat, frequently perforated with cuts or lunules. Ambulacral furrows of under side more or less branching; tubercles and spines of upper and lower surfaces differing in size.

ECHINARACHNIUS.

28. *E. excentricus*, Val.

This is the common cake-urchin of the Pacific coast, found at all points from Sitka to Monterey, and also at Kamtschatka. It is extremely common at the mouth of San Francisco Bay, where it lives in great numbers on the bar, on a bottom of sand and a little mud, at a depth of from five to seven fathoms. The district inhabited by it extends for a length of four or five miles, and the width of a mile along the west and southwest part of the bar.

29. *E. mirabilis*, A. Ag.

This author gives Japan as the habitat of this species; but it is also found in Alaska, as we have two fine specimens from the Shumagin Islands, presented by W. H. Dall.

30. *E. parma*, Gray.

A. Agassiz gives New Jersey, Labrador, Vancouver Island, Kamtschatka, and Australia as habitats of this species. Our collection contains some specimens from Hakodadi, Japan, presented by W. J. Fisher.

MELLITA.

31. *M. longifissa*, Mich. Panama. Gulf of California.

ENCOPE.

32. *E. Californica*, Verrill. Panama. Mazatlan. Gulf of California.

One of our specimens is curiously deformed anteriorly and posteriorly, so that its transverse diameter greatly exceeds its longitudinal diameter. The abactinal side is jet-black, with a velvety surface of small spines; but the actinal side, where the spines are comparatively large, is of a mouse tint.

33. *E. grandis*. Gulf of California.

Of this massive species we have one fine specimen, presented by W. G. W. Harford.

Sub-order PETALOSTICHA.

These *Echini* have no teeth; the anal system is separate from the apical; the ambulacra are petaloid; the test is less flat than in the Clypeastroids; certain parts of the test and spines are greatly specialized; and the radiate form is accompanied with an evident bi-laterality.

Family CASSIDULIDÆ.

Petalosticha without plastrons or fascioles, on which the spines are arranged differently to the rest of the test. They approach the Clypeastroids in many respects, but have no teeth, and in form simulate the regular *Echini*.

ECHINONEUS.

34. *E. cyclostomus*, Seska. Australia. Kingsmills. Zanzibar.

35. *E. semilunaris*, Gmelin. Florida. East India Islands.

RHYNCHOPYGUS.

36. *R. Pacificus*, A. Ag. Gallipagos. Panama. Gulf of California.

Family SPATANGIDÆ.

The actinal part of the test occupied by a plastron, with bare ambulacral avenues defining its sides. Other plastrons formed by fascioles or bands of crowded miliary spines. The combinations of the plastrons and fascioles, with the shape of the test and petals, are the principal characters used in distinguishing the subfamilies and genera.

MARETIA.

37. *M. planulata*, Gray. Kingsmills. China. East Indies. Mauritius.

LONENIA.

38. *L. elongata*, Gray. Red Sea. Australia. Philippines.

BREYNIA.

39. *B. Australasiæ*. China. Australia. Japan.

A very fine specimen, 3⅞ inches long by 3⅛ inches broad, probably presented by W. Garrett, from the Sandwich or Society or Kingsmill Islands, as I found it in company with the crustacea collected by him in those localities.

ECHINOCARDIUM.

40. *E. cordatum*, Gray. Norway. Mediterranean. Britain. Brazil. Florida.

AGASSIZIA.

41. *A. scrobiculata*, Val. Panama. Gulf of California.

BRISSUS.

42. *B. carinatus*, Gray. Society, Sandwich, and Philippine Islands. East India. Mauritius.

ADDITIONAL SPECIES.

[Acquired since date of List.]

ARBACIADÆ.

Arbacia Dufresnii, Agassiz. Patagonia. Chili. Navigator Islands.
Locality of specimens in museum not known.

ECHINOMETRADÆ.

Colobocentrotus atratus, Brandt.

Specimens collected at the Paumotu Islands. Collected and presented by Capt. M. Turner. The species occurs also at Zanzibar, Java, and Sandwich Islands.

"Stimpson says that *C. atratus* is found at the Bonin Islands, adhering, simply by their suckers, to the perpendicular faces of rocks, exposed to the full fury of a Pacific Ocean swell. We must remember that the test of this genus forms, with its spines, a flat segment of a sphere, and that the close pavement of polygonal spines presents but little surface to the action of the water. The suckers of the actinal side are also very powerful and numerous." —*A. Agassiz*, "*Rev. Echini.*"

SCUTELLIDÆ.

Mellita testudinata, Klein.

Specimens from Galveston, Texas, presented by Mr. J. R. Scupham.

Dr. Blake called the attention of the Academy to investigations he is making in determining the molecular properties of minerals.

REGULAR MEETING, AUGUST 16, 1875.

President and Vice-Presidents being absent, Dr. Kellogg was called to the Chair.

Twenty-five members present.

Donations to the Museum: Silver ore from Nevada, from O. G. Leach. Thirteen specimens of ore, from Louis Lewis. Three specimens of ore, from L. Kaplan. Twenty specimens of Durangite, from Jos. T. Boyd. Five specimens of ore, from B. B. Minor. Four specimens of ore, from Geo. W. Dent; also from the same donor, nut gall, vegetable wax from the Andes, Orchilla from Mexico, Camel's hair from Calcutta, and Chinese envelopes. From A. J. Severance, specimens of rock, (core from Diamond Drill) from Oregon, California and Australia. Quicksilver ore from Santa Clara County, from A. K. Grimm. Silicified wood found 300 feet deep in Manzanita Mine, Nevada County, Cali-

fornia, from J. H. Wood. Fossil shells from Contra Costa County, and Cement Rock from same locality, donated by F. A. Walley. Silver ores from Jas. D. Stevenson.

A collection of forty-eight specimens of birds and mammals was presented by Professor Esmark, of the Royal University of Norway.

Dr. Kellogg spoke of his recent trip to Mendocino County. Among other things he had discovered there a true thorn—a California production.

Dr. Gibbons spoke of the remarkable climatic phenomena occurring last winter both here and in Europe.

REGULAR MEETING, SEPTEMBER 6, 1875.

Vice-President Edwards in the chair.

Thirty-four members present.

Joseph O'Connor, J. P. Moore and G. H. Sanders were elected resident members.

Wm. Barber and E. Pander were proposed for membership.

Donations to the Museum: From A. W. Crawford, twenty-four species of Marine shells from California, Mexico and New Zealand; ten species of fresh-water shells from the eastern rivers of North America; twenty-one specimens of minerals, Arizona, California and Colorado. Mr. W. J. Fisher presented fifteen species of Marine and Land shells from Japan. Charles Kaeding donated eight Ornithological specimens. Mr. Blunt presented specimens of *Procyon Hernandzii*, *Taxidea Americana* and *Mephites occidentalis*. Mr. F. Gruber presented specimens of *Cardinalis igneus*, *Cyanospiza cyanea*, *Leucostictea tephroctes*, and Japan thrush. Mr. G. W. Dent donated Kouri gum from New Zealand, and crude India Rubber from Mexico. J. G. Riley

presented ore from Lake County. Cornelius Cole presented fibrous Asbestos from Maryland and from Elko County, Nevada.

Mr. Edwards spoke of his recent trip to Mt. Shasta, particularly with reference to the California "Pitcher Plant," (*Darlingtonia Californica*) found in great abundance in that locality, as follows:

Darlingtonia Californica. Torrey.

BY HENRY EDWARDS.

Some time since I promised to bring before the notice of the Academy the few facts I had observed with regard to the remarkable pitcher-plant (*Darlingtonia Californica*), and by adding to them as much information as I could collect with reference not only to this species, but also to those allied to it in habits and structure, it is my hope that more extended observations may yet be made by some of our members upon this very singular product of the vegetable kingdom.

The *Sarracceniaceæ*, the family to which our *Darlingtonia* belongs, is one of the smallest known to botanists, containing only three genera and eight species. Its place in classification has been assigned between *Nymphæaceæ*, the family of the water-lily, and *Papaveraceæ*, that containing the poppies. Its geographical distribution is remarkable, the whole of the species of the family being confined to the American continent. Thus, the genus *Sarracenia* contains six species, all of them natives of the Atlantic States, and only one of them having at all an extensive range, viz.: *Sarracenia purpurea*, of Linnæus, which is found from lat. 48 N. to Southern Florida, and westward as far as Ohio. The remaining species *S. pittacina*, Michx., *S. rubra*, Walt., *S. Drummondii*, Croome, *S. flava*, Lin., and *S. variolaris*, Michx., are all confined to the Southern States; the last named species being probably the most abundant, the others being only met with in favored localities. According to Dr. Asa Gray, the genus was named by Tournefort in honor of Dr. Sarrazin of Quebec, who early in the present century forwarded a description of the best known species, viz., *S. purpurea*, to Europe. Since the time of its discovery, plants have constantly been forwarded to England and to the Continent, and now very many of the greenhouses of the old world boast the possession of our pitcher flowers. Another genus, *Heliamphora*, of Bentham, contains but one species, *H. nutans*, Benth., a native of boggy places in British Guiana. It is remarkable in its family for the scape containing sometimes five or six nodding, blush-white, or rose-colored flowers; those of the other genera being solitary, and mostly dull yellow, or purplish in color. The remaining genus, *Darlingtonia*, is a native of this State, and the only one of the group found west of the Rocky Mountains. It contains but one species, *D. Californica*, the subject of our present consideration.

This remarkable plant was first described by the late Dr. Jno. Torrey from specimens forwarded to him by I. D. Brackenridge, Assistant Botanist to the

United States Surveying Expedition under Captain Wilkes, in 1842, who detected it growing in a marsh bordering a small tributary of the Upper Sacramento River, a few miles above Shasta Peak. Dr. Torrey, in his description, which will be found in the "Smithsonian Contribution to Knowledge, Vol. VI, 1853," says:

"Owing to the lateness of the season (it was October), the flowers had passed, and not even a single seed-vessel was found, but only the leaves and tall scapes, with the remains of a single capsule. The leaves, however, were so peculiar that no doubt was entertained of the plant being either a *Sarracenia*, or a near ally of that genus. Without the flowers, nothing further could be determined respecting it; but, from the bracteate scape and deeply parted lamina of the leaves, it seemed more than probable that it was distinct from *Sarracenia*. Long had I been hoping to receive the plant in a more complete state, when it was at last brought to me by my friend, D. G. W. Hulse, of New Orleans, who found it in flower in May, 1851, in the same region, and perhaps in the very spot in which it was discovered many years before by Mr. Brackenridge. The plant proves to be generically distinct from *Sarracenia*, as well as from the genus *Heliamphora* of Bentham; and I take great pleasure in dedicating it to my highly esteemed friend, Dr. Wm. Darlington, of West Chester, Pennsylvania, whose botanical works have contributed so largely to the scientific reputation of our country. The genus dedicated to the veteran botanist by De Candolle has been reduced to a section of *Desmanthus* by Bentham; and a California plant, from an imperfect specimen of which I had recently indicated a genus under that name, proves to be only a variety of *Styrax*."

It may be well to add to this interesting note of Dr. Torrey, that *Darlingtonia* differs generically from *Sarracenia* by the forked blade of the leaf, and by the shape of the stigma. The flower of the former is stated to be, "when fully expanded, about two inches in diameter; the calyx consists of five straw-colored acute sepals; the petals, of a like number, and pale in color, are narrowed and concave at the apex and broad below; the twelve to fifteen stamens are nearly hidden by the projecting ovary, which is top-shaped, slightly five-angled, and crowned by a short style, with a five-lobed stigma. The fruit is a five-celled capsule, with numerous seeds." I may here remark that, though the flower is said by Dr. Torrey to be nodding at the apex of the stalk, I did not find it so. In August last, when I first met with the plant in the neighborhood of Mount Shasta, the flowers had become perfectly erect, and most of the capsules had burst and discharged their seed. It struck me that this may be owing to a careful provision of nature, which afforded the plant, as it became erect in ripening, an opportunity of spreading its seeds to a greater distance than it could do if the flower continued in a drooping position. The seeds themselves are armed at their extremity with small bristles, which cause them to adhere to the *Sphagnum* and other bog plants of their habitat, and thus secure them against being washed away by any excess of water in the bogs in which the plant has its home. Interesting as the flower of *Darlingtonia* is, however, it yields in general attractiveness to the leaves, which are not only peculiar in form and structure, but perform one of those curious functions in nature, the object of which we can by no

means clearly understand, but which are none the less calculated to excite our wonder and admiration. Viewed from a little distance, a growth of *Darlingtonias* presents a most beautiful and singular appearance, having a fanciful resemblance to a number of yellow hooded snakes, with head erect, in the act of making the fatal spring. I may here observe incidentally, that *caput-serpentis* would have been an appropriate specific name. The bright yellow, and, in some cases, almost orange color of the hoods, also suggests a growth of giant orchids; and it is probably, in some degree, to this resemblance to a flower that the leaves are indebted for their faculty of entrapping insects, which is the most remarkable feature of the plant. The leaf, which is tubular for the whole length, sometimes reaches the height of three feet six inches, and has a peculiar twist in its stem, always bending in one direction, the course of this twist being marked on the edge of the leaf by a winged membrane, increasing in width from the base to its termination at the mouth of the pitcher. The apex of the leaf is a large, swollen, reticulated hood, sometimes, in well grown plants, as large as a man's fist, divided in front and above the opening into two lanceolate lobes, which are curved downwards, and are strongly marked with purplish veins, these colored veins being also continued on the inner surface of the tube for about one-third of its distance. For more than half its length the interior of the tube is smooth and marked with semi-transparent reticulations, but from that distance to the base it becomes more opaque; and it is furnished with a closely set series of fine, spinous hairs, laid thickly against the walls of the tube, and all pointing downwards. Examined under the microscope, these hairs present no trace of barbs or hooks, but are simply sharp points, hardened and toughened towards their extremity.

The whole of this structure appears to be admirably adapted for the singular habit of ensnaring insects, which is so wonderful a feature of the economy of *Darlingtonia* and its allies. The insects may easily be led to mistake the brightly colored hood for a flower, and wandering into its treacherous recesses, find a smooth passage at the top of the tube lighted by the reticulations of the leaves, and excreting a slight amount of viscous substance, slightly sweet, and of the consistence of honey. Passing along this passage, they at last reach the bottom, find on attempting to retrace their steps that escape is impossible, and their wings becoming useless by contact with the viscid discharge from the walls of the leaf, and the moisture secreted at the bottom of the tube, they sink to their death in large numbers, the tube sometimes being filled to the depth of from six to seven inches with the remains of insects in the various stages of decomposition.

I do not attempt to speak authoritatively upon the subject, but I am inclined to think that no process similar to that of digestion goes on within the plant, but that the fluid mass derived from the decay of the imprisoned insects descends through the tube into the earth, and is taken up by absorption, through the roots, thus acting as a kind of liquid manure. It is true that in the dead leaves the hard integuments of insects, such as the elytra of beetles, and the bodies of wasps and hornets are to be found undecayed, but this may be because the liquid secreted by the plant is not powerful enough to cause decomposition of these parts before the plant itself decays. An analysis of

the fluid found within the tube, and of the leaf itself, would be of service to decide this point, but the structure of the plant prevents the rejection of particles not needed for its subsistence, as is the case with *Drosera*, *Utricularia*, and *Dionea*. It would appear that all order of insects are lured to the fatal embrace of *Darlingtonia*, and it astonished me to find that I could recognize so many species among the remains I examined. I cut open and carefully studied the contents of about forty tubes in all, and found that I could distinguish no less than forty-three species of insects, which I am able to tabulate as follows:

Order—*Coleoptera:* Genera—*Platynus*, *Serica*, *Coccinella* (2), *Hippodamia;* number of species, five.

Order—*Hymenoptera:* Genera—*Apis*, *Vespa*, *Ichneumon;* number of species, three.

Order—*Orthoptera:* Genera—*Acrydium* (2), *Tettix* (?); number of species, three.

Order—*Neuroptera:* Genera—*Mantispa*, *Myrmeleo*, *Agrion;* number of species, three.

Order—*Diptera:* Genera—*Tipula*, *Musca*, *Tachina*, *Asilus;* number of species, twenty or more.

Order—*Lepidoptera:* Genera—*Colias*, *Agrotis*, *Botys;* number of species, three.

Order—*Hemiptera:* Genera—*Notonecta*, *Reduvins* (?) (2); number of species, four.

Order—*Arachinda:* Genera—(unknown); number of species, two.

It is probable that this list could have been very considerably increased, but I was sufficiently convinced that all the insect orders were represented in the seething pot of the *Darlingtonia's* kitchen. The greenest tubes—those which are of comparatively recent growth—seem to be less attractive to insects, and I have always found the largest quantity of remains in those which are richest and deepest in color. Across the opening of the hood a small spider, seemingly allied to the genus *Thomisus*, spins its web, as if aware of the attractive nature of the plant, and conscious that its own prey could be thus easily captured. I have also invariably found among the mass of decay some living larvæ of a small dipterous insect, probably one of the *Tipulidæ;* and I observe that a similar circumstance has been recorded by Dr. I. F. Mellichamp of Bluffton, North Carolina, with reference to the pitchers of *Sarracenia variolosa*. Dr. Mellichamp's paper is so interesting that I make no apology for transcribing the following: "The base of the tube of *S. variolosa* secretes a watery fluid, which is not sweet nor odorous, but which proves quickly fatal to all insects that fall into it. The whole inner surface is covered with very minute, closely appressed prickles, perfectly smooth, and pointed downwards, which render it impossible for an insect to ascend by walking, even when the leaf is laid nearly horizontal. Within the somewhat dilated rim of the tube, there is a band half an inch in width, dotted with a sweet secretion, attractive to insects, but not intoxicating. This also extends downwards to the edge of the outer wing to the very ground, thus alluring many creeping

insects, and especially ants, to the more dangerous feeding ground above, where once losing foothold, it is impossible to regain it. Even flies escape but rarely, the form of the tube and lid seeming to obstruct their flight. As the result, the tube becomes filled to the depth of some inches with a mass of decaying ants, flies, hornets and other insects.

Within this there is always found a white grub feeding upon the material thus gathered, perhaps the larva of a large fly which has been observed to stand upon the edge of the tube, and drop an egg into it. Soon after the full development of the leaf, the upper portion becomes brown and shrivelled, which is due to still another larva, the young of a small moth, which feeds upon the substance of the leaf, leaving only the outer epidermis, and works its way from above downward, until in due time it spins its cocoon, suspending it by silken threads just above the surface of the insect debris at the bottom. The whole forms a series of relationship, and an instance of contrivance and design, the full purport of which is by no means fully understood." It will thus be seen that the same general habit obtains through the whole family of *Sarraceniaceæ*, though in details there are to be found differences in some striking particulars. In the first place, it is more than probable that the liquid secreted in the base of the tubes of *Sarracenia* is pure water, deposited from the atmosphere,* but the shape of the hood in *Darlingtonia*, which totally covers the opening of the tube, suggests some other cause for the presence of moisture at its bottom. This liquid, which is *Sarracenia*, is said by Dr. Mellichamp to be inodorous, is in our California plant most disgusting in its smell, and after handling a number of specimens of the tubes, it is necessary to use some disinfectant like ammonia or chloride to remove the disagreeable ordor. The larva found among the debris of *Sarracenia*, though belonging undoubtedly to the dipterous order, is nevertheless of a totally different genus from that found in *Darlingtonia*, as the latter are very minute, almost microscopic in size, though it is possible that more than one species may yet be discovered. I should also state that I found no ants whatever in the tubes of *Californica*, though subsequent observations may yet add to our knowledge the fact of their presence among the victims. Nor can I find any trace of a lepidopterous larva, like that noted by Dr. Mellichamp, which was probably the early stage of some species of *Tortrix*. Careful and continued observation will, however, doubtless bring to light many new facts connected with the economy of this singular plant. The stems of *Darlingtonia* are generally marked with some ferruginous blotches, which are due to the presence of a small fungus, which has been examined by our fellow-member, Dr. Harkness, and by him pronounced to be a new species of *Trichobasis*. Dr. Harkness, while intending to publish the results of his observations, permits me to add that he proposes to name the species *Trichobasis Darlingtoniæ*. The Indians of the district around Mount Shasta are well acquainted with the fly-catching habit of *Darlingtonia*, but I regret to say that I could not discover their native name of the plant, nor could I learn that they ascribe to it any medicinal proper-

* NOTE—I have since been assured by Dr. Mellichamp that the liquid is by no means pure water, but an excretion of the plant itself. H. E.

ties. I was the more surprised at this, as I was aware that to *Sarracenia purpurea* is credited a large amount of virtue in cases of small-pox, a paper on its efficacy in this terrible disease having been contributed to *Land and Water* in 1871, by Captain Hardy of the Royal Artillery, who spent some time in Newfoundland, and who derived his knowledge of the value of the pitcher plant from the Indians of that region. The portion of the plant used is the root, which has been introduced into England, and is sold there at the high rate of 28 shillings per pound. I mention this fact as it is more than probable that our own species may possess some hidden virtue which may prove equally as valuable to mankind.

I may state that *Darlingtonia*, though certainly a local plant, is by no means rare in the districts in which it is found. The locality nearest to San Francisco in which it has been detected is in the foothills of the Sierra, about 10 miles from Nevada City. It is, however, most abundant in the region about Mount Shasta, where it may be found in at least thirty or forty places within a radius of fifteen or twenty miles. It grows in boggy spots on the sides of mountains, and particularly about those known to hunters as "deer licks," which are abundant along the banks of the Upper Sacramento and its tributary streams. Extreme altitude is not necessary to its growth, as it is found from 1,000 to 5,000 feet. Mr. Robinson, of the *Field* newspaper, who visited this country a few years ago, chiefly for the purpose of observing the plant in its native haunts, states that it is by no means difficult of cultivation, and that it is "best treated by being grown in a soil of peat or peat and chopped sphagnum, kept wet, not merely moist, the pots or pans to be placed on a wet bottom—frame or cool-house treatment being the best in winter, warm greenhouse or temperate stove in summer."

In concluding these imperfect remarks, perhaps I may be permitted to hope that they may be the means of directing more perfect attention to this remarkable plant, which must always be regarded as one of the many vegetable wonders of California.

Regular Meeting, September 20, 1875.

In the absence of the President and Vice-Presidents, Charles Wolcott Brooks was called to the Chair.

Fifty-two members present.

Donations to the Museum: From L. Higbee, Los Angeles, specimen from an artesian well 189 feet deep. From Henry Chapman, Fossil Shells—cretaceous—from Alameda County. From F. A. Walley, Fossil Shells found in sandstone in Marin

County. From C. C. Coleman, Ramie fiber. From C. D. Gibbes, fibrous Asbestos and Manganese. From Star & Mathison, Plumbago from Ceylon, Antimony from Nevada, and "Regulus" from San Francisco. From Charles Reed of San Mateo, Argentiferous Galena from Sacramento mine, San Mateo County, Gold ore from San Gregorio Creek, and Indian implements (stone) from Redwood City. From G. W. Dent, two Lizards from China as prepared for medicine by Chinese. From J. Daniels & Co., Scotch Granite. From Holmes & Dawson, Suisun Marble. From Fred. MaCrellish, Sulphur from Sulphur Banks, Humboldt County, Nevada.

Mr. Williamson read a paper on "Fish Culture."

T. J. Lowry read a paper describing a new method of determining positions in Hydrographic Surveying, as follows:

A New Method of Determining Positions of the Sounding-Boat—Application of the Two-Point Problem to Hydrographic Surveying.

BY T. J. LOWRY.

This is called the age of practice—the inventive age. And, undoubtedly, the prevailing tendency of the science of this age is synthetic. The problem it places before itself is not so much to discover isolated truths as to combine, to harmonize, to generalize, to utilize those already found out. Instead, then, of indulging in ineffectual wanderings in the labyrinths of analytics, let us pause for a moment in the field of synthetical geometry—where Euclid, Newton, and Bessell deigned to labor—and see if there are not "seed fallen by the wayside, among rocks and in stony places," which we may cause to yield profitably for the exact arts.

The increased traffic and travel on the rivers, bays, lakes, gulfs, and oceans, within the last half-century, have made the accurate mappings of the topography of these water-basins of the earth commercial, national necessities. The civilized nations of Europe have long felt and acted upon these demands of navigation and commerce; nor has the United States been left in arrears, for already has she executed a system of hydrography—even extending her researches into the Gulf Stream and kindred inter-ocean rivers—securing results which challenge at once the wonder and admiration of the scientific and navigating worlds.

The hydrographic chart is the lamp to the navigator's path over the intricate windings of the waters of the earth; the revealer of rocks, shoals, reefs, hidden beneath smiling seas, and therefore the secret to a safe navigation, and hence successful international commerce. Does it not, then, gentlemen, behoove us, as a scientific body, to make all possible improvements in the theory and practice of hydrography?

Hydrographic surveying was reduced to a real, a practical entity, by the discovery of the three-point problem, by Pothenot. This problem being wide in its application, accurate in its determinations, and yet most simple in its graphic solutions, has, from the first, stood the grand central truth of practical hydrography. But to fix a position by this problem is required, on three known points, two connected angles observed simultaneously. And with only two known signals in sight it utterly fails to fix a position. Now it is to remedy these defects, to fill up these gaps left open by the three-point problem, and thus enable the hydrographer to determine his position under a wider range of contingencies, that I propose the application of the two-point problem to hydrographic surveying.

In determining positions of the sounding boat, equal in accuracy, and second only in point of usefulness to the three-point problem, is the two-point problem, which, with its many varied phases and fewer known points, greatly increases the hydrographer's capability of ascertaining his position under every contingency. This problem determines any two points on an unknown range (or inter-range) if at each of these points are measured the (two) angles contained by this range and two known signals. The boat's path may either coincide with the range or inter-range (see Fig. 1), or cross it at two or more points (as shown in Fig. 2). In the first case we can fix the position of the boat at any two or more instants by "angling" at those instants on two known signals ("*A*" and "*B*"), and the undetermined range. When the boat only crosses the range at two or more points, its position can be fixed by this problem only at these points, and that, of course, by "angling" at the very instants of crossing the range. The better conditioned the quadrilateral, formed by the two known points and the two places of observation, the better will these places be determined; and will be wholly undetermined when the right line, through the places of observation, prolonged, traverses either one or both of the observed signals.

Where ranges are ready prepared for us—as when adjacent to cities with their flag-staffs, chimneys and spires, or where the country rises into highlands and mountain peaks back from the shore—the determination of a boat's position by this problem is alike easy and expeditious. And even where nature does not offer such ready prepared facilities, we can readily supply them, where the water is comparatively shallow, by dropping temporary spar buoys (a pole with rock to one end). One buoy will furnish a stern range, if we have another visible stationary object directly astern, or an inter-range if directly ahead. But if there is no such stationary object visible, then continue the line of soundings, and drop further along a second buoy, and at the same instant measure the angles contained by two known signals, and the first buoy, and from another point on the range of these buoys, catch the angles between this range and any two known signals, and the soundings are determined. By cutting on a third point on shore, from two or more of these determined positions of the boat, it can be fixed in position without visiting the shore or even stopping the sounding boat; other signals may thus readily be substituted for those swept away by storms, etc.

The buoys thus dropped being determined fixed points, may serve as signals for carrying a hydrographic triangulation further on out off shore. This

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problem will thus prove most useful in the survey of off-shore shoals and reefs, and in the location of buoys, where only two signals are in sight. And it may, moreover, be found especially serviceable in the surveys of those large shallow bodies of water which abound along the Atlantic and Gulf coasts of the Southern States, where the low shores and hazy atmosphere render it extremely difficult to keep three signals in sight.

The geometrical construction of this problem is accomplished in the following obvious manner: On *A B*, in Fig. 3, describe segments containing respectively the angles *A M B* and *A P B*, draw the chord *B y*, to cut off segment, *B A M y*, containing the angle, *B M y*, and another chord *A x*, cutting off segment, *A B P x*, containing the angle, *A P x*. The points. *x* and *y*, will be in the same right line with *M* and *P*; join *x y*, which produce both ways till it cuts the circumferences in *M* and *P*, which will be the required places of observation.

The triogmetrical analysis furnishing the readiest means for computing this problem, is that known as the indirect. Thus, let any number, as 10 or 100, represent *m p*, in Fig. No. 1. Then in the triangle, *A m p*, are known the angles, *A m p*, (=*A M P*), and *A p m* (=*A P M*), with side, *m p*, from whence *A m* may be found. In the triangle, *m p b*, are known angles, *m p b* (=*M P B*), and *b m p* (=*B M P*), with *m p*, to find *b m*. Now, in the triangle, *A m b*, are known angle, *A m b* (=*A M B*), and the sides, *A m* and *b m*, from which *A b* may be found. And now, from the similarity of figures, *A b* : *A B* : : *m p*: *M P*, and by like proportions any other of the required sides may be found.

The two-point problem finds a ready graphic solution by laying off each set of observed angles on a separate piece of tracing paper, and shifting these two papers until the lines of sight traverse each its proper point, then prick the vertices of these angles on to the sheet, and they are (*M* and *P*) the required points of observation.

But a neater graphic solution, based upon very obvious geometrical considerations, is found in the three-arm protractor: with the angles measured at *M* (see Fig. 3) set off on the proper limbs of the protractor, cause its left and middle arms to traverse *A* and *B*, and draw a line along its right arm. Shift center of protractor to some point, as *m*—taking care to keep *A* and *B* bisected by left and middle arms—and draw another line along right arm and *y*, the point of intersection of these lines, will be a point in the right line through the places of observation, *M* and *P*. Now, set off the angles observed at *P* on the corresponding limbs of protractor, bisect *A* and *B* with the fiducial edges of the middle and right arms. Draw line along left arm; shift center of protractor to some point as *p*, and with middle and right arms still bisecting *A* and *B*, draw line along left arm, and *x*, the point of intersection of these two lines, will be a second point in right line through *M* and *P*. Draw an indefinite right line through *x* and *y*. Now, with the angles observed at *P* on the protractor, cause its middle and right arms to traverse *A* and *B* while the true edge of its left arm coincides with line through *x* and *y*; dot its center, and we have *P*, one of the places of observation; and, in like manner, find *M*, the other place of observation.

These are the solutions of the case of this problem where only two known signals are involved. There are, however, two other cases: First, where from one position of the boat signals A and B are visible, but from the other only B and C are seen; here the boat's positions are equally well determinate, and the geometrical construction and graphic solutions are the same as above given—but the trigonometrical analysis varies slightly (see Narrien's Geodesy). And in the second case, where first position of boat sees only signals A and B, and its second position only C and D, these positions are still determinate, and the graphic solutions and geometrical construction are identical with those already given, but the trigonometrical analysis is different, as shown by the writer on page 19, vol. 2, of *The Analyst*.

The two-point problem may, moreover, be found most serviceable in restoring lost stations. Suppose the case illustrated in Fig. No. 4—where (the surface mark of) station G is lost and its restoration is desired. Having an approximate idea of the position of the lost station, G, choose two such points, M and P, as make at once the quadrilateral, $A\ B\ P\ M$, and the triangles, $A\ M\ G$, $B\ P\ G$ and $G\ M\ P$, "well conditioned." Then at M and P successively measure the angles $B\ M\ A$, $B\ M\ P$, $A\ P\ B$ and $A\ P\ M$, and find—either by construction or computation, as above shown—the unknown sides and angles of the quadrilateral, $A\ B\ P\ M$. Now from the original triangulation are known the sides $G\ A$ and $G\ B$, and angles $G\ A\ B$, and $G\ B\ A$; and the angle $G\ B\ P = P\ B\ A - G\ B\ A$. We hence have two sides, $G\ B$ and $P\ B$, and included angle, $G\ B\ P$, to find $P\ G$ and angle $B\ P\ G$, the distance and direction of the lost station, G, from the point, P. But if no linear measure is available, then mark the direction of G from the point, P, by range poles, $n\ o$, and shift the theodolite to M. Find angle, $A\ M\ G$, in like manner to that which found angle, $B\ P\ G$. Then cover A with telescope, turn it in azimuth equal to angle, $A\ M\ G$, and mark the direction of its line of sight with poles, $i\ h$. We then have marked out two ranges, $i\ h$ and $o\ n$, intersecting at "the lost station," G.

And equally applicable when on land searching for a lost station with three signals in sight, is the maneuver so well understood in hydrography of taking from the sheet the angles subtended by the three signals at the lost station, setting them off on two one-angle, or one two-angle sextant, and shifting the position of the observer till the images of these signals coincide in his horizon glass, when he will be close on the "lost station."

Dr. Blake read the following:

On the Results of Glacial Action at the head of Johnson's Pass, in the Sierras.

BY JAMES BLAKE, M. D.

In a recent trip in the Sierras, at the head of the south fork of the American River, I met with some evidences of glacial action which I think are worthy of being recorded as furnishing some indications of the character of the climate during the middle part of the glacial epoch. The head of the valley

of the south fork of the American River terminates in Johnson's Pass, a gap in the western summit of the Sierras, about 7,500 feet above the level of the sea. The break in the mountains extends for about a mile and a quarter from north to south, and is nearly level. The upper part of the American Valley, for three or four miles, rises by a gentle slope up the pass, and is from half a mile to a mile wide, with a flat meadow bottom of mountain meal, bounded on each side by moraine blocks, lodged against the sides of the mountains. The head of the pass terminates by a pretty steep escarpment which forms a part of the western boundary of Lake Tahoe Valley, lying about 1,000 feet below. The south side of the American Valley, near the pass, is formed by a mountain about 9,000 feet high, the face of which, opposite the head of the pass, suddenly changes its direction, turning to the south to form the west wall of the southern termination of Lake Valley. To the north, the pass is separated from Echo Lake Valley by a vast bank of moraine matter, which formed at one time a lateral moraine of Echo Lake glacier, but which has been subsequently increased and gradually sloped off towards the valley by the bed of the glacier being forced up over it during the middle of the glacial epoch. As this Echo Lake glacier has evidently been an important element in causing the glacial action at the upper part of the American Valley, a short description of its old bed will be useful. The Echo Lake Valley is about four miles long, running in a direction southeast, northwest, and terminating towards the northern or upper end in a perfect amphitheater, surrounded by high peaks. The chord of this amphitheater or cirque measures probably two miles and a half, affording ample area for the formation of a vast glacier. The valley abuts to the southeast against the western wall of Lake valley at the north termination of the depression which forms Johnson's Pass. The bottom of the valley is now occupied by two lakes, one of which is a mile and three-quarters long, and a quarter of a mile broad, with a depth of water of 150 feet. The other, or upper lake, is smaller and not more than thirty-five feet deep. They are separated by a belt of rock a few yards broad, in which the granite presents a more schistose character. The rocks on the border of the lake show evident marks of glacial action to a height of [illegible] feet above its level, and moraine matter has been deposited fully [illegible] feet higher, so that the Echo Lake glacier must have been between seven and eight hundred feet thick. During the earlier part of the glacial epoch it was precipitated over an almost perpendicular cliff, a thousand feet high, into Lake Valley, and whilst pursuing this course it piled up a vast moraine on its south west border, the upper end of which terminates at a height of about [illegible] feet above the level of the lake. This now forms the divide between Echo Lake and the American River Valley. The true nature of this embankment is well shown where it terminates toward Lake Valley and also at the upper part where it joins a spur of the mountain; but the greater portion of it has been so completely [illegible] with [illegible] mountain meal and the few rocks that appear on the surface are so completely rounded and polished that but for the appearance of the upper and lower ends, its true character as a lateral moraine would not be suspected.

As before stated, the lower end of the American Valley terminates at the edge of the escarpment forming a portion of the sides of Lake Valley and [illegible]

was evidently over this escarpment that the glacier flowed during a long time; but as Lake Valley itself became filled with ice, and its glacier reached to the height of six or seven hundred feet above the side of the valley at Johnson's Pass, Echo Lake glacier could no longer escape into the valley, but was deflected with the vast ice stream from Lake Valley down the valley of the American River. In taking this new direction, the bed of the glacier was forced up over what had been before its lateral moraine, grinding off the angles of the rocks, and filling up the interstices with mountain meal, so that the moraine, particularly towards the American Valley, presents a gentle slope, with only an occasional boulder visible. The Echo Lake side of the embankment is much steeper, and a few feet below its crest has a ridge of moraine rocks, with perfectly sharp edges. This ridge is separated from the top of the embankment by a shallow depression, a few yards broad. These rocks had evidently been deposited on the ridge of mountain meal as lateral moraine, after the Lake Valley glacier had retreated below the level of the pass so that the Echo Lake glacier could resume its former course.

On the south side of the head of the pass, a large quantity of moraine matter has been deposited from the glacier coming in from the south end of Lake Valley. Until Lake Valley itself had been filled with ice up to the level of the pass, the moraine matter from this glacier would be deposited in the valley; but as soon as the ice reached the level of the pass, a large moraine was deposited, extending nearly half a mile across the head of the pass, and then bending to the west down the American Valley. This moraine, at the point where it leaves the mountain, is apparently about four hundred feet high, and a quarter of a mile thick at its base, and is composed of large masses of granite, with their edges quite sharp. Even a mile below the head of the pass, the moraine is 150 feet high and 400 feet thick, here forming the north wall of the basin of Andrean Lake, a small lake about 300 yards long and 250 broad, situated directly at the foot of the mountain, on the south side of the American Valley. The rocks at this part of the moraine are more or less rounded, and the interstices filled with the finer detritus. The middle of the valley, near its head, and for some distance down, is covered with a thick deposit of mountain meal, interspersed with large boulders, which have evidently been glaciated from the northeast. This has been opened to the depth of twenty feet without reaching the country rock. It is completely unstratified, and contains a few boulders, well rounded, but not very large, at least such was the case in a cut and tunnel made in the deposit towards the north side of the valley. In making the cut, a layer of gravel was found about eighteen inches from the surface; it was about two inches thick, and composed of rounded quartzose and other pebbles, and must have been derived from some disintegrated conglomerate beds. The only probable source of this thick deposit of finer detritus is from the bed of Echo Lakes, and the glaciated mountains to the northeast of the lower lake. It is found forming the bed of the American Valley for three or four miles from the summit of the pass, but beyond this point it gradually disappears, so that, at six miles from the summit, it was found extremely difficult to find any dirt to fill into the crevices between the rocks, when making a road through the valley.

Such is a general sketch of the results of glacial action at the head of American Valley—results which could only have been produced under totally different climatic conditions than a mere diminution of the mean annual temperature. It is evident that the formation of the large moraine across the head of the pass, from the glacier coming from the head of Lake Valley, could only have taken place when the surface of the mountain at the head of the pass was uncovered by snow, at least during a part of the year; or, in other words, at the time that the glacier in Lake Valley had attained a thickness of more than a thousand feet, there was no permanent glacier at the head of the pass. At present, the snow by the end of the winter is from ten to twenty feet deep at the head of the pass, and from four to eight feet deep in Lake Valley, and it has melted in the valley six to eight weeks before it disappears from the head of the pass. With a colder climate, in which, however, the relative temperature of the summer and winter should be the same as at present, it is evident that long before the Lake Valley glacier had attained a thickness of one thousand feet, a glacier some hundreds of feet thick must have occupied the head of the pass, so that the moraine matter brought down by the southern tributaries of Lake Valley glacier could not have been deposited there, but must have been carried down the valley of the American River as soon as the Lake Valley glacier was thick enough to force the ice stream in that direction. The most probable climatic conditions under which such a deposition of moraine matter as is found at the head of the American Valley could take place are, a colder winter with a very heavy snow-fall, and a hot summer, during which the snow would be removed from the surface, even at an elevation of 7,000 feet, when not fed by glaciers. The gradual filling up of Lake Valley by ice, was the result of the many glaciers coming into it on all sides, as has been shown by Prof. J. LeConte, and which had their origin in mountains from 1,500 to 2,000 feet above the level of the pass. That these ice streams were pouring into Lake Valley when the head of the American Valley was comparatively free from ice, is proved, also, by the formation of the large lateral moraine, from Echo Lake glacier, on the north side of the valley. Another fact that would indicate the rapid disappearance of ice at the upper part of the American Valley during the height of the glacial epoch is, the comparatively slight longitudinal extension of the glaciers down the American Valley. Although there is undoubted evidence that in Lake Valley, and at the head of Johnson's Pass, the ice attained a thickness of six hundred feet above the level of the pass, yet the larger part of the terminal moraine matter has been deposited within six or seven miles of the head of the pass, and at an elevation of only 1,000 feet below the top of the pass. Now, the rapid disappearance of this American Valley glacier, fed, as it was, by the Echo Lake glacier, and also by the vast ice stream from Lake Valley, would indicate that it must have been exposed to a much higher summer temperature than prevails at present. The topographical formation of the American Valley would also favor the melting of the ice, as the valley opens directly on the heated plains of the Sacramento, and thus affords a channel for the hot air of the plains during the summer, and for the moisture-

laden air from the warmer ocean that probably existed far on into the glacial epoch.*

Should the facts above stated admit of the interpretation I have given them, it is evident that they are inconsistent with the views of those who regard the glacial epoch as the result of mere geological changes in the distribution of land and water. That these changes may have played a subordinate part in intensifying the influence of cosmical causes is probable, just as the immense outflows of volcanic rocks, covering so many thousands of square miles of our continent to the depth of 1,800 to 2,000 feet, must have exerted a great influence on the warmer climate of the Miocene. In fact, as I have before stated to the Academy, I believe the heated term of the Miocene is much more easily referable to geological causes than is the cold of the glacial epoch.

Without wishing to attach too much importance to the facts above stated, I think the evidences of glacial action at the head of Johnson's Pass are inconsistent with any other hypothesis than that, far on in the glacial epoch, cold winters, with heavy snow-falls, alternated with very hot summers; and also that, at the same period, there was no permanent ice-covering on the surface at an elevation of 7,000 feet above the sea, at least in these latitudes. It is, I think, only in such climatic conditions that the vast moraines at the head of Johnson's Pass could have been formed, particularly the embankment moraine on the north side of Andrean Lake. This moraine could not have been formed by a glacier pushing its end out into water, as Professor LeCompte has shown was probably the case with similar moraines in Lake Valley and Mono Lake. The only conditions under which the moraine on the south side of the American Valley could have been formed was, that the surface on which it rests was not covered by ice at the time the Lake Valley glacier had reached the level of the head of the pass. The glacier from the head of Lake Valley, by far the largest entering the valley, then deposited a lateral moraine, stretching some distance across the head of the American Valley. As the ice accumulated in Lake Valley, and began to deflect the Echo Lake glacier to the west, the glacier from the south end of the valley was also forced in the same direction, depositing its moraine where the surface was still uncovered by ice, and thus laying the foundation on which moraine matter subsequently lodged, as the rapidly melting ice during the summer months exposed its surface, even after the rest of the valley was permanently covered with ice.

The accompanying rough plan shows the deposition of moraine matter at

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*It is probable that a glacier has extended some distance down the American Valley below the point indicated, but this I believe to have been later in the glacial epoch, when the glaciers at the head of the valley were possibly diminishing in thickness, and after the great ice sculpturing in the higher mountains had been effected. I believe that it was in the earlier stages, and during the height of the glacial epoch, that the principal ice sculpturing took place, caused by the sudden and great alternations of temperature. The moraine matter deposited by the retreating glaciers was evidently very slight, in comparison with that deposited whilst they were increasing.

the head of Johnson's Pass. I regret that, owing to an accident to my mountain barometer, I was unable to obtain exact hypsometrical measurements.

NOTE.—Since this paper was written, I have read Mr. Croll's work, *Climate and Time*, of which a large part is occupied in attempting to prove that during the glacial epoch the summers must have been colder than at present. As the grounds on which his argument is founded are more or less hypothetical, and his conclusions are, I think, inconsistent with the slight horizontal extension of the ancient glaciers, not only in the Sierras, but, as I have shown, also in the Puebla mountains, I must conclude that at least in this part of the earth's surface the glacial epoch was marked by cold winters with very heavy snowfall, and hot summers. The glacier coming from the south end of the Puebla range offers even a more marked example of slight horizontal extension than that at the head of the American Valley. This glacier had its origin in a valley six miles long and a mile broad, surrounded by peaks from 6,000 to 7,500 feet high, and which still retain snow on them during the whole year. At the height of the glacial epoch, this valley must have been filled by a vast glacier which escaped into the Puebla Valley, the latter valley being at an elevation of 4,600 feet above the sea; and yet under these circumstances the terminal moraine does not extend more than a mile and a quarter into the valley, although at its head, or near the foot of the mountain, it has probably a thickness of three hundred feet.

Mr. Lockington presented a communication drawing the attention of the Academy to the unhealthy condition of the building, suggesting remedies therefor, and that a committee be appointed to collect funds to improve the premises.

Special Meeting, September 28, 1875.

Vice-President Edwards in the Chair.

Thirty-five members present.

By request of Mr. Edwards, General Colton, President of Board of Trustees, explained the object of the Special Meeting. He stated that the Board of Trustees had held a special meeting, at which Messrs. Felton and Hittel, Attorneys for Mr. Lick, were present. At this meeting Mr. Felton had read such parts of Mr. Lick's new deed, dated September 21, 1875, as were changed from the deeds of July 16, 1874, and September 16, 1875. The Trustees had informally agreed to the changes made by Mr. Lick. At the same meeting a deed was read, dated September 21, 1875, giving to the Academy, without any restrictions whatever, the property on Market Street, formerly deeded by

Mr. Lick to the Academy with certain restrictions, which are set forth in a deed dated October 14, 1873.

This was also informally accepted by the Trustees. Although the Trustees, under the law, and the Constitution of the Academy, are authorized to take charge of the property of the corporation and attend to its temporal affairs, the Board had thought it proper in a matter of this importance, to call a meeting of the Academy to endorse the action of the Trustees, or authorize them to act. It was explained that the new deed to the property on Market Street was eminently advantageous to the Society. Also that the new "Trust Deed" affected the Academy very slightly; and as all the other beneficiaries but one had signed, it only remained for the Academy to assent before sending it East for the signature of John H. Lick.

General Colton called on the Secretary to read the Resolution which the Board of Trustees proposed to adopt.

The Resolution was then read as follows:

Resolved, That the California Academy of Sciences do hereby accept the deed of James Lick, party of the first part, Richard S. Floyd, Faxon D. Atherton, Sr., Bernard D. Murphy, John H. Lick and John Nightingale, parties of the second part, and the California Academy of Sciences, the Society of California Pioneers, the Protestant Orphan Asylum, the Ladies' Protection and Relief Society, the Mechanics' Institute, and the Society for the Prevention of Cruelty to Animals, the City of San José, A. B. Forbes, J. B. Roberts, Ira P. Rankin, Robert McElroy, J. D. B. Stillman, Horace Davis, A. S. Hallidie, John Oscar Eldridge, and Lorenzo Sawyer, parties of the third part, which said deed is dated September 21st, 1875, and all the terms and conditions thereof, and do hereby release and discharge the said above-mentioned parties of the second part, in said deed named, from the performance of any of the duties imposed upon them by those certain deeds mentioned therein, dated respectively on the 16th day of July, 1874, and the 16th day of September, 1875, which are inconsistent with the terms and conditions of said first-mentioned deed.

Resolved, further, That David D. Colton (President) and Charles G. Yale (Secretary), of the Board of Trustees of this corporation, be and are hereby instructed to seal, sign, acknowledge, execute and deliver said first-mentioned deed in the name of this corporation, and with their names attached as such President and Secretary of the Board, and affix the corporate seal of this Academy thereto; and their acts in compliance with the above instructions are hereby ratified and confirmed as the act and deed of this corporation.

Resolved, further, That this corporation also accepts and receives that certain other deed from James Lick, party of the first part, to the California Academy of Sciences, party of the second part, dated September 21st, 1875.

By request of the presiding officer, Mr. Hittel, who was present with the new "Trust Deed" of James Lick, explained the changes which had been made in this, compared with the former one.

Mr. Hittel then read the deed to the property on Market Street, stating that it had been acknowledged by Mr. Lick. It is as follows:

JAMES LICK

TO

CALIFORNIA ACADEMY OF SCIENCES.

This Indenture, made and entered into this 21st day of September, 1875, between James Lick, of the City and County of San Francisco, State of California, party of the first part, and the "California Academy of Sciences," a corporation organized and existing under the laws of the State of California, and having its principal place of business at the said City and County of San Francisco, the party of the second part, witnesseth:

Whereas, Said party of the first party heretofore executed and delivered to the said party of the second part, a certain deed, dated on the fifteenth day of February, A. D. 1873; which said deed was duly recorded in the office of the County Recorder of the said City and County of San Francisco on the 20th day of February, A. D. 1873, in Liber six hundred and ninety-six (696) of Deeds, commencing at page three hundred and sixty-four (364), which said deed conveyed the following described piece or parcel of land in said City and County of San Francisco, State aforesaid, circumscribed by a line commencing at a point on the south-easterly line of Market Street distant one hundred and ninety-five feet south-westward from the south-westerly corner of Market and Fourth Streets, and running thence south-easterly and parallel with said Fourth Street, one hundred and ninety-five (195) feet; thence south-westerly at an angle of forty-five degrees to a point two hundred and seventy-five (275) feet from said south-easterly line of Market Street, which said last mentioned point constitutes the south-westerly corner of the hundred vara lot hereinafter mentioned; thence north-westerly and parallel with said Fourth Street, two hundred and seventy-five

(275) feet to said south-easterly line of Market Street; thence north-easterly and along said mentioned line of Market Street eighty (80) feet to the point of commencement. Said parcel of land being a portion of that certain lot of land laid down and commonly known upon the official map of said City of San Francisco, as one hundred vara lot number one hundred and twenty-six (126), with certain reservations and exceptions, and upon certain terms and conditions subsequent, all of which are fully expressed in said deed, reference to which said deed is hereby expressly made.

AND WHEREAS, Said party of the first part afterwards executed and delivered to the said party of the second part a certain other deed dated on the Third day of October, A. D. 1873, which said deed was duly recorded in the office of the County Recorder of the said City and County of San Francisco on the Fourteenth day of October, A. D. 1873, in Liber seven hundred and eighteen (718) of Deeds, commencing at page three hundred and eighty-seven (387), which said last mentioned deed granted, gave, conveyed and confirmed to said party of the second part, all the lands and premises described in said first mentioned deed and above described, with certain reservations and exceptions, and upon certain other terms and conditions subsequent, all of which are fully expressed in said last mentioned or second deed, reference to which is hereby expressly made.

NOW THEREFORE, In consideration of the premises and the respect and esteem said party of the first part has and bears to the said party of the second part, and the desire of the said party of the first part to further promote the prosperity of the party of the second part, and for the benefit of the Sciences in general, and in order to relieve the said party of the second part from all the terms and conditions subsequent, contained in said above mentioned deeds, or either of them, and from any and all terms, conditions and provisos, if any exist, the said party of the first part hath granted, given, confirmed, remised, released, and forever quit-claimed, and by these presents does grant, give, confirm, remise, release, and forever quit-claim unto the said party of the second part all the lands and premises described in said above mentioned deeds and hereinbefore described.

To have and to hold, all and singular, the premises hereby granted, given, confirmed, remised, released and quit-claimed

unto the said party of the second part and its successors, in fee simple, absolute, and without any conditions whatsoever.

In witness whereof the said party of the first part has hereunto set his hand and seal the day and year first herein above written.

(Signed,)

JAMES LICK. [L. S.]

[Recorded September 29th, 1875, at 20 minutes past 10 o'clock, in Liber 801 of Deeds, page 253.]

After the reading of the deed, the resolutions prepared by the Trustees and before read, was again read by the Secretary.

On motion of Dr. George Hewston, seconded by Charles Wolcott Brooks, the Resolution was adopted as read.

On motion, the Trustees were requested to convey the thanks of the Academy to Mr. Lick.

REGULAR MEETING, OCTOBER 4TH, 1875.

Second Vice-President in the Chair.

Forty members present.

Dr. G. F. Becker was proposed as a candidate for membership.

Donations to the Museum: Fourteen botanical specimens from Lower California, by G. W. Dunn. Tusks of Wild Boar from Santa Rosa Island, from W. G. Blunt. Rock from Choumagin Islands bearing specimen of *Terebratulina septentrionales*, dredged from forty fathoms by W. G. W. Harford. Fragments of ancient pottery, and one botanical specimen, from T. J. Butler, Prescott, Arizona. Insects from La Paz, from Dr. D. E. Hungerford. Hawaiian cotton, presented by C. C. Coleman. Silver ore from Arizona, by James Riley, Cerbat, Arizona. Two specimens of silver ore from Inyo County, from J. R. Frink. Sixty-eight specimens of minerals from various localities, from R. H. Sinton. Thirteen specimens of ore from White Pine, from T. H. Wells. Four specimens imitation marble on slate, and one specimen imitation porphyry on slate, from I. T. Milliken, San

Francisco. One specimen *Fontinalis antipyritica*, from R. K. Nuttall. Crustacean, from Dr. W. H. Jones, U. S. S. *Portsmouth*. Specimen of Manna found on Eucalyptus on State University grounds. Mr. Stearns said this was the first discovery of the kind on any Eucalyptus in California.

Dr. Blake read the following paper:

On Phylloxera.

BY JAMES BLAKE, M. D.

During the last week, I visited one of our extensive vineyards in Sonoma county, for the purpose of investigating, as far as a few hours would permit, the Phylloxera question, and as what I observed may be interesting to some, I will briefly state the results of my observations.

The proprietor of the vineyard was not certain, before I commenced my investigations, if any of his vines were affected. All he had observed was, that in separate patches about the vineyard the vines looked sickly. Some of them had died, and others were evidently dying; but, he stated, as he had noticed the same sort of thing for years, he did not attribute this to the new pest, although disease amongst the vines had never shown itself to the same amount as at present. In exposing the roots of one of the badly diseased vines, it was found to be covered by the insect. From two or three inches below the surface to as far down as the roots were traced (four feet), every crack and crevice in the outside bark of the root, was literally lined by Phylloxera. The vines in which this occurred were evidently in a dying condition. They had pushed out a few weakly shoots in the spring, which had not grown more than a few inches, and they had a few aborted bunches of grapes. They certainly would be dead next year. I noticed, in exposing the roots of the vine, that there were no superficial roots, at least, living. Some remains of dead roots were found on digging down, but nothing alive except the main roots. The lowest roots were not exposed, but from the escape of sap from the cut surfaces of the roots, it was evident that a certain amount of absorption was going on, and therefore that a large portion of the smaller rootlets must be uninjured. The roots of apparently a perfectly healthy vine were then examined. The plant had made quite a luxurious growth, some of the shoots being from six to eight feet long, and it had on it about fourteen pounds of grapes, which appeared to be ripening perfectly. The Phylloxera was found on the roots, but in much smaller numbers than in the other vine. Here they were confined to one or two cracks in the bark, and although pretty thick in these cracks near the surface, they were only met with in small patches at a foot under ground. These roots were followed down to a depth of more than four feet, at which depth a patch of Phylloxera was found, which consisted of not more than a dozen insects. About six inches above this was another patch, containing a larger number of individuals, and about every six or eight inches up the surface patches of the insect were

found, the size of the patches becoming larger as they were found nearer the surface. They were confined exclusively to a single longitudinal crack in the bark, at least from where the roots divided, about two feet beneath the surface. As before stated, they were found in patches, no insects being seen in the spaces between the patches. It was evident the crack in the bark of the root had offered a route by which the insect was gradually making its way down on the root. The patches undoubtedly indicated the stages by which the insect proceeded downwards, one insect from above passing over the intervening space and establishing a new colony, from which pioneers again started out to descend still lower. From the few insects found in the lowest patch, it is probable that this portion of the root had but just been attacked, and that not more than one generation had been born there. On some small roots that were given off about a foot from the surface, I found but one insect, and that near the main root. The soil of the vineyard was a gray clay, containing a considerable quantity of sand. It was derived from the disintegration of volcanic sedimentary rocks, and as it had been well ploughed and harrowed, it was quite fine and dusty. Under these circumstances, it is quite certain that the insect would not reach the roots of the vine through cracks and holes in the ground, as it is stated to do in France. Here there can be no doubt but that the migrations of the insect took place down the cracks in the outer bark, which not only afforded it a road, but also enabled it to introduce its sucker into the softer cambium, from which it derives its nourishment, and which it could not have reached through the whole thickness of the bark.

The fact of the infection of an apparently healthy vine, offers a serious prospect for the future wine prospects of the State, as it is impossible to say to what extent the disease already exists. It is probable that its effects only become manifest after it has already existed on a vine perhaps for years, and I think it likely that it will be found far more widespread than is now anticipated. I have, however, taken measures to ascertain this point, and I trust these remarks may call the attention of our wine-growers to the subject, and lead them to look for the insect amongst their apparently healthy vines. My own opinion is, that when a vine has once been attacked by the insect, it is merely a question of time as to when it will be killed, and the facts above stated show how hopeless it is to expect to be able to eradicate it when once it is established. In order to do this, we should have to expose the roots of the plant, and apply our remedies below the lowest point where the insect has penetrated. This is simply impossible. The only chance I see for successfully meeting the disease is, to endeavor to prevent its attacking vines that are already healthy, and I think this can most likely be effected in a manner that may not involve too much expense. There are two considerations in the history of the insect, which lead me to hope that this may be done. In the first place, I believe that at least in loose, pliable soil, that is kept well cultivated, the insect can only find access to the roots by crawling down the cracks in the bark, or in the crevices that are generally found about the root at the surface of the ground. I think it probable that some application, such as tar or train oil, that might be distasteful to the insect, might prevent its crawling down the stem; and surrounding the stem for a few inches with fine,

sharp sand, would not leave any cracks by which it could find its way beneath the surface. Again, the same means would be available for preventing its spreading. It appears that the way it spreads from one locality to another is, that at certain seasons of the year some of the insects become possessed of wings. These then come to the surface and deposit their eggs on the leaves of the vine, being often carried to some distance by the winds, and by this means alone it would appear that the diseased area becomes enlarged. Now, the same plan that would prevent the insect from descending to the roots would also still more effectually prevent these winged Phylloxeras from coming to the surface and extending the area of the disease.

Unfortunately, notwithstanding the attention that has been given to the subject in Europe, the natural history of the insect has been but imperfectly elucidated. Perhaps when we come to know more about it other means may suggest themselves for controling its progress. Up to the present time no remedy has been found for it, and if I may be allowed to express an opinion on the subject, it is because it has been looked for, I believe, in the wrong direction, by endeavoring to destroy the insect on vines that are already diseased. For reasons above stated, I believe this to be impracticable. The plan, I think, that will be found available, will be to give up the vines already attacked, and endeavor to preserve those which are not already infected.

Dr. Blake read the following paper:

On the Reimer Grape.

BY JAMES BLAKE, M. D.

In a communication I read before the Academy, last November, I related some analyses that I had made of the juice of different varieties of grapes, more particularly in relation to their fitness for making wine. Amongst the grapes anaylzed was one called the Reimer, in connection with which the following facts may be interesting: The day after I had received the grapes, the proprietor of the vineyard called on me, and on looking over the grapes that his manager had sent me, told me when he saw that there was a sample of the Reimer amongst them, that there was no necessity for me to analyze that, as he had given orders to have all the vines of that variety to be destroyed. As I, however, had already commenced the analysis, I went on with it, and discovered that this grape was possessed of what I considered the best properties for wine making. On making this discovery, I requested the owner of the vineyard to have some wine made from the juice of this grape unmixed with any other. This was done, and although it is yet rather early to judge of the wine, yet it certainly, at present, promises to be the best California made wine I have yet tested, and orders have now been given to preserve every shoot and sprout of the Reimer for propagation. It is certainly the most desirable grape for California that I have yet met with. It is a very free grower, and I believe even a more prolific bearer than the Mission grape. It will be seen by the analysis, published in the last volume of the proceedings,

that it is the variety that contains the most malic acid, and the wine made from it has certainly developed more bouquet than any California made wine of the same age I have yet tasted, thus supporting the views I then advanced as to the influence of malic acid in developing the aroma of wine. It would seem that the viniculturai mind is at last waking up to the value of malic acid in wine-making, as a comparison of the prices paid for the different varieties of grape, with the data furnished by my analyses, will show:

	Malic acid per cent.	Price in Napa Valley per ton.
Zinfindel..............................	0.60	$23.00
Reissling	0.57	18.00
Mission	0.11	10.00

Some sixteen years ago I endeavored to call the attention of our vine-growers to the necessity of propagating the more acid varieties of grape; but until within the last three or four years the greater part of our vineyards have been planted with the old Mission grape, undoubtedly the worst wine grape that can be selected.

Regular Meeting, October 18th, 1875.

Second Vice-President in the Chair.

Thirty-five members present.

Donations to the Museum: Three boxes of recent Sea water Shells, from R. H. Stretch. Photographs of relics from mounds, by Mr. Putnam. Mr. S. Jennings, through Dr. Gibbons, presented a pearl taken from a shell found at the Navigator Islands; also the shells. J. F. Jerome presented specimens of the Candle Nut from what the Sandwich Islanders call the "Ku Kui" tree. Black Marble from Alaska, from J. Daniels. Minerals and Fungus, from J. F. Jerome; also specimen of *Holothuria* used as food by the Chinese, shark's fins from China, Orchilla from Lower California. R. H. Sinton presented specimens of Copper ore. C. C. Parry donated specimen of mountain mahogany. Dr. A. Kellogg presented Trout from Inyo County, and seventeen specimens of Lichens. James Behrens presented specimens of radiated pyrites from Prussia.

Mr. C. D. Gibbes described the Candle Nut presented as the fruit of the *Aleurites triloba*, a tree of the family *Euphorbiaceæ*, grows 20 to 30 feet high; leaves tri-lobed; fruit about two inches in diameter; inner nut very hard shell, within which the meat is preserved for years; good to eat, but rather rich. The oil is easily expressed, and is sent to England for candle making. As a drying oil it ranks among the best. The Hawaiians string the kernels of the nuts on slender strips of bamboo and light them as candles; they burn with a peculiar but pleasant odor.

Dr. G. F. Becker read a paper on "Notes on a new feature of the Comstock Lode."

Dr. Hermann Behr made some remarks on "Phylloxera."

Henry Edwards read the following paper:

Pacific Coast Lepidoptera, No. 15.—Description of a new species of Catocala, from San Diego.

BY HENRY EDWARDS.

Catocala Augusta. n sp. Hy. Edw.

Primaries. Ground color, very pale fawn-color, almost whitish. All the lines, particularly the sub-terminal, strong and distinct. Basal space, rather large, covered with black irrorations; basal half-line, almost obsolete. T. a., broad on costa, with a double tooth; thence slightly arcuate to a space beyond the middle, there forming a deep tooth, and bent again to the internal margin. This line is deep velvety black, edged anteriorly by a whitish shade. T. p., with a deep median double tooth, running obliquely from the median nerve to the internal margin, in a series of four teeth, and near the margin lost in a brownish shade. Reniform, large, distinct, whitish, edged with black. Sub-reniform, also, large and white, both with grayish shade posteriorly. Sub-terminal line, very strongly marked, with deep but even teeth, edged anteriorly with gray shade. Sub-terminal spots between the nervules, well defined, oblong, deep black. Fringes whitish, mottled with brown.

Secondaries. Rosy red, with yellowish tinge. Mesial band, moderate, almost straight inwardly until it reaches the middle, when it narrows and terminates about 2½ lines from abdominal margin. Marginal band also moderate, with two rather prominent teeth near the anal angle. Apices, broadly yellow. Emarginations and costa, also, with yellow shade. Fringes, white. Abdominal margin, clothed with fawn-colored hairs.

Underside. The black bands of primaries are very broad; the white ones very clear and distinct; the sub-basal one not reaching the interior margin; and the posterior one much wider on the costa than on the internal margin.

I.

II.

1. Bulimus pallidior, *Sby.*
2. Helix Veatchii, *Newc.*

Secondaries, two-thirds pale yellowish red, the mesial band narrower than on the upper side.

Expanse of wings, 3.30 inch.

Locality, San Diego, Cal. Mrs. Jas. Behrens.

The upper wings of this beautiful species recall the shade of the European *C. Fraxini*, but they are still paler in color, and with the lines even more distinctly marked. Its nearest ally is *C. Luciana*, Hy. Edw., from Colorado, but it differs from that species by its paler gray color, by the reniform and sub-reniform being whitish instead of black, by the lines being more deeply and regularly toothed, and by the extreme distinctness of the subterminal line. The color of the secondaries have also a more rosy tint than those of *Luciana*.

For this interesting addition to our insect fauna, we are indebted to Mrs. James Behrens, who has frequently added great rarities to her husband's collection, and to whom, through the medium of her given name, I have great delight in dedicating it. Mrs. Behrens took two specimens of this charming insect in August last, in the neighborhood of San Diego.

Mr. Stearns read the following paper:

On the Vitality of Certain Land Mollusks.

BY ROBT. E. C. STEARNS.

I submit for the inspection of the Academy a living specimen of *Bulimus pallidior*, Sby., one of nine given to me by Prof. Geo. Davidson, who collected them at San José del Cabo, Lower California, in March, 1873.

These snails were kept in a box undisturbed until June 23d, 1875, when I took them out, and, after examination, placed them in a glass jar with some chick-weed and other tender vegetable food, and a small quantity of tepid water, so as to make a warm humid atmosphere. This hospitable treatment induced them to wake up and move about after their long fast and sleep of *two years, two months and sixteen days*. Subsequently all died but this, which seems to be in pretty good health, though not very active.

It may be remembered that I mentioned before the Academy at a meeting in March, 1867, an instance of vitality in a snail (*Helix Veatchii*) from Cerros Island, even more remarkable, the latter having lived without food from 1859, the year when it was collected, to March, 1865, a period of *six years*.

The famous specimen in the British Museum which is cited in the books, *Helix desertorum*, had lived within a few days of four years, fastened to a tablet in one of the cases, when discovered to be alive.

Helix desertorum, as the specific name implies, is found in arid and sterile areas, in the continents of Africa and Asia, and has, as will be perceived, a wide distribution. From the former continent, I have specimens from Egypt, and it also ranges through Arabia in the latter.

The *Bulimus* from the main-land of the peninsula of Lower California, and

Helix Veatchii from Cerros or Cedros Island, off the coast on the ocean side of the same, come from within the same physical environment, being comparatively a limited distance apart.

The *Helix* belongs to an interesting and peculiar group, probably varieties of one species, which includes, at present, the following names: (1) *Helix areolata*, Sby., (2) *H. Veitchii*, Newc., (3) *H. pandoræ*, Fbs., and (4) *H. levis*, Pfr. Other forms geographically approximate may hereafter, on further investigation, be referred to the same lineage.

Of the above, (1) *H. areolata* was the first described, or I should say that this appears by the date to be the first name bestowed upon any member of the group. This species has been quoted from Oregon, and (4) *H. levis*, from the Columbia River, in both cases erroneously. The figures in "Land and Fresh Water Shells of North America,"* p. 177, are too elevated and globose for the typical *areolata*, but the larger figures faithfully represent *H. Veatchii*. Elevation and rotundity are insular characteristics in this group, and *areolata* is comparatively depressed. It is found in considerable numbers on the uplands around Magdalena Bay, which is on the outer or ocean shore of the peninsula, in latitude about 24° 40′ N.

Bulimus pallidior, which is pretty generally distributed through Lower California, from Cape St. Lucas northerly, has also erroneously been credited to San Diego in California proper. It is arboreal in its habits, at least during the winter season, and frequents the Copaiva trees. It has been said to inhabit South America, *which is probably incorrect*, and the locality "San Juan," mentioned in "L. and F. W. Shells," on p. 195, where a good figure of this species may be seen, should be *San Juanico*, which is on the *east* side of the peninsula, in latitude about 27° N.

The great importance of particularity in habitat will be at once perceived when I state that there are no less than *three* other localities on the west coast of America, *north* of the place cited, all of which are referred to in various scientific works which have come under my observation, as "San Juan," and there are perhaps as many more "San Juan's" *south* of that especially quoted herein, on the westerly coast of America, in the Central and South American States.

Attention is directed to the fact that the three species herein mentioned as exhibiting extraordinary vitality, belong to geographical areas, which receive only minimum rainfall, or which are, in simple language, nearly rainless regions.

Within such areas vegetation is exceedingly limited even in favorable seasons, and the presence and growth of the annual plants is, of course, dependent upon the rainfall; this last occurring infrequently makes the food supply of land mollusks and other phytophagous or vegetable-eating animals exceedingly precarious.

It is highly probable that a careful investigation in this direction will lead us to the conclusion that the land mollusks which inhabit arid areas have, through selection, adaptation and evolution, become especially fitted for the

*Smithsonian Misc. Coll., No. 194.

contingencies of their habitat, and possess a greater degree of vitality or ability to live without food than related forms in what may be considered more favorable regions, and through and by reason of their long sleep or hibernation, *more properly estivation*, with its inactivity and consequent immunity from any waste or exhaustion of vital strength, are enabled to maintain their hold upon life when animals more highly organized would inevitably perish; and we are furnished with an illustration, in the instances cited, how nature works compensatively, when we institute a comparison with the opposite condition of activity, and the food required to sustain it.

Mr. Stearns called the attention of the Academy to certain fossil forms of the genus *Scalaria*, belonging to the sub-genus *Opalia*, discovered by Mr. Hemphill near San Diego.

REGULAR MEETING, NOVEMBER 1ST, 1875.

Dr. Stout was called to the Chair in the absence of President and Vice-Presidents.

Twenty-eight members present.

Messrs. Charles W. Banks and G. F. Becker were elected resident members.

Donations to the Museum: From W. E. Burleigh from Island of St. George, Alaska, one full-grown male fur seal, one full-grown female fur seal, one fœtus (nearly full grown) of fur seal, one young sea lion two months old, head of walrus two years old. The fur seal are carefully collected specimens, complete and suitable for preservation.

Mr. Filhol was introduced by the Chairman and made a few remarks.

Dr. Gibbons made some verbal remarks on the difference in the rainstorms here and in the Eastern States.

Dr. Parry read a short paper in relation to botanical subjects in California.

Regular Meeting, November 15th, 1875.

Second Vice-President in the Chair.

Twenty members present.

Louis Nusbaumer was nominated for membership.

Donations to the Museum: A box of minerals containing 45 specimens, from Dr. E. S. Holden, Stockton. Specimen of Colymbres, presented through Dr. Harkness. Two birds from Navigator Islands, presented through Dr. Gibbons. Specimen of *Cebidichthys crista galli?* Ayres, from Captain Lawson, U. S. Coast Survey. Five specimens of fish from the lower waters of Kern River, from J. R. Scupham. Silicified wood from Sonoma County, by G. H. Saunders.

S. C. Hastings read a letter from Professor J. D. Whitney relative to the "Botany of California," to the effect that the work was nearly completed and ready for publication.

J. R. Scupham made some verbal remarks on the Toredo, presenting also a specimen of wood showing a curious instance where one of the rotifers had bored into the hole of its neighbor, the first instance where such an occurrence had been noticed.

A verbal discussion on the subject of Phylloxera was participated in by Dr. Behr, Dr. Blake, Dr. Kellogg and S. C. Hastings.

Regular Meeting, December 6th, 1875.

Second Vice-President in the Chair.

Thirty-five members.

T. W. Greene and Dr. Murphy were proposed for membership.

Donations to the Museum: Twenty-six specimens of Native Woods, presented by Mr. Joseph H. Clarke, Cahto, Mendocino County. Native Fishes, W. N. Lockington. Three specimens

of Fish and nine specimens of Crustaceans from Captain M. Turner. *Pinus aristata*, Dr. A. Kellogg. Acorns and branch of *Quercus fulvescens*, George W. Dunn. Specimen of *Artemia Utahensis*, from Dr. Harkness. Two Crustaceans and thirty-two specimens of *Myriapoda*, from Henry Edwards.

Dr. Kellogg explained that the donation of woods from Mr. Clarke was very valuable, all the specimens being in fine order and carefully prepared. A vote of thanks was passed to Mr. Clarke.

Dr. Harkness exhibited a map presented by General Stone, through Governor Purdy. The map shows the work done by American Engineers in Africa for the Egyptian Government, in the course of a survey.

Mr. W. N. Lockington read a description of the fish presented at the previous meeting.

Mr. Lockington also read a paper on Landscape Gardening, giving a list of the varieties of plants and shrubs adapted to California gardens, and containing suggestions as to the proper laying out of grounds.

Dr. J. G. Cooper presented the following:

New Facts relating to Californian Ornithology—No. 1.

BY J. G. COOPER, M. D.

The publication of the volume on Land Birds in the series of Reports of the Geological Survey of California brought down the history of that class of animals, for the most part, to 1870, although, having been written five years previously, many additional facts had accumulated, which could not be introduced into it, as only stereotyped proof-sheets were sent to me for correction. Some of these facts have been published by me in our Proceedings for 1868, Vol. IV, p. 3, as "Some recent additions to the Fauna of California," and more or less contributed to the "American Naturalist," or the following more recent works. The present remarks are intended to include only such later items as have never been published, or such opinions as differ from those of later authors. The following are the chief works relating to this subject that have appeared since 1865:

Birds of Ft. Whipple, Arizona, or Prodrome of Ornithology of Arizona Territory. By E. Coues, A. M., M. D., U. S. A. From Proc. Phila. Acad. Nat. Sciences, Jan. 1868.

The New and heretofore Unfigured Birds of North America. By D. G. Elliott. New York, 1869. Folio.

List of Birds of Alaska, with biographical notes. By Wm. H. Dall and H. Bannister. From the Proc. Chicago Acad. of Sciences, 1869, 4to. Also Mr. Dall's later articles in our Proceedings, on Alaskan birds.

A History of North American Birds, by S. F. Baird, T. M. Brewer, and R. Ridgway, Land Birds, in 3 vols., small 4to. Boston, 1874.

Birds of Western and Northwestern Mexico, from Collections of Col. A. J. Grayson, Capt. J. Xantus, and F. Bischoff. By G. N. Lawrence. From Memoirs of the Bost. Soc. of Nat. Hist., 1874. 4to.

Birds of the Northwest (the region of the Missouri R.) By E. Coues, M. D., U. S. A. Washington, 1874. 8vo.

Report on Ornithological Specimens collected in the Years 1871, 1872, and 1873, in Nevada, Utah, and Arizona. By Dr. H. C. Yarrow, H. W. Henshaw, and F. Bischoff. Washington, 1874. 8vo.

For convenience of reference, I give the pages of Ornithology of California, Vol. I, where the species are described.

TURDUS NANUS—The Dwarf Thrush, page 4. The notes given by me in the lower five lines of this page belong properly to the next species, as it is scarcely probable that any of this remain in the lower country of California, or even in the mountains in summer, unless above an elevation of 8,000 ft., as does its Rocky Mountain representative, var. *Auduboni* Baird. The song of that, and of the eastern race, var. "*Pallassi*" Cab., being described as resembling that of the Wood Thrush (*T. mustelinus*), with which I am familiar, I am sure that I never heard it in the Sierra Nevada up to 8,000 ft. alt., nor in the forests of Washington Territory, and that of var. *nanus* cannot be very different.*

It is the winter thrush of California, common from September to May.

As pointed out by me in the Amer. Naturalist, Jan. 1875, the name *nanus* has priority over *Pallassi*, but that of *guttatus* Pallas, 1811, will very probably become the specific appellation, being founded on a specimen from Kodiak, where this only is found. The description, however, is as applicable to young of *Myiadestes Townsendii*, and it was called a "*Muscicapa*." Bonaparte, in Comptes Rendus, 1854, thinks it is "very certainly the *T. Swainsoni*, but *may* not be the *T. Pallassi* of Cabanis." The size, however, does not agree with either of them, and perhaps for this reason Cabanis substituted *Pallassi* (founded on a Cuban specimen) for his *T. guttatus*, 1844, founded on Pallas's bird. The African *T. guttatus* Vigors, need cause no confusion, being doubtless a later named species.†

T. USTULATUS—Oregon Thrush, p. 5. This name is also prior to those of its eastern representatives. Townsend and Audubon confounded it with *T. fuscescens* ("*Wilsoni*"), which opinion was formerly endorsed by J. A. Allen; while Coues in 1872, and later authors, make it a variety of "*T. Swainsoni*" Cab. This, besides being named later, was described as from Siberia,

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* The song described by Ridgway as of *T. ustulatus* in the Sierra Nevada, and like that of the Wood Thrush, was more probably that of *T. nanus*.

† *T. Aonalaschkæ* Gmel answers still better to the young of *T. nanus*, and could scarcely be a fringilline bird, as suggested by Baird, for Gmelin described the three spotted sparrows from there as "*Fringilla*," &c. *Melospiza Lincolnii* could scarcely be confounded with it. See farther on, under *Passerculus Sandwichensis*.

and a comparison of types seems needed to establish its identity. As, however, it is reported as straggling to Central Europe (as well as "*Pallasi*") it might much more easily reach Siberia from Alaska, where it appears to go farther north than var. *ustulatus*. The claim of "*T. brunneus*" Boddært, 1783, as being of this species, seems worthy of further examination.

I was misled in giving *T. nanus* as the common Summer Thrush of California, both by its having been given by all previous authors as the only small brown thrush found in the State (*ustulatus* being limited to the north), and by Heermann's positive assertion that it breeds in the oak groves near San Francisco, where I am now satisfied that only *ustulatus* spends the summer. I have since found the latter breeding as far south as lat. 35° at least, and probably to lat. 33°. There they are more olive than at the Columbia, approaching var. "*Swainsoni*," and are also smaller, as might be expected. This southern residence suggests that the Mississippi valley summer thrush of Audubon, and Wilson's Georgia birds, with similar nest and eggs, are the var. "*Swainsoni*," these authors not recognizing its distinctness from var. "*Pallasi*."

Our bird does not reach California from the south before April 15th, and leaves during September, thus supplementing the winter residence of *T. nanus* so fully, that they are easily mistaken for one species, more noisy and conspicuous in summer, their upper plumage being nearly the same in California.*

* The following measurements taken by me from fresh birds now preserved in the Smithsonian Institution, the State Museum of California, and my own collection, show that there is such a gradation in size between specimens of the two species collected in different latitudes, that no difference is noticeable in living birds at gunshot distance. The older specimens are recorded in P. R. Rep. IX, 213, 215, etc.

Species.	Locality.	Date.	Sex.	Length.	Extent.	Wing.	Cat. No.
T. ustulatus	Wash. Terr.....	May 31, 1854	† ♂?	8.00	12.25	3.75?	S. I. 8171....
"	" "	" " "	† ♀?	7.25	11.75	" ?	" 8172....
"	Saticoy, Cal ...	Sept. 7, 1873	♂	7.00	12.25	4.15	J. G. C. 1559.
"	" "	May 6, 1874	♂	7.00	11.40	3.75	" " a
T. nanus	St. Clara, Cal...	Nov.18, 1855	‡ ?	7.00	10.50	3.30?	S. I. 4483....
"	" " ...	" " "	‡ ?	6.50	9.25	" ?	" 5943....
"	Ft. Mojave, Cal.	Jan. 25, 1861	♂	6 50	10.50	3.35	J. G. C. 64 ..
"	Saticoy, Cal	Nov. 7, 1873	♀	6.50	10.40	3.35	" " a.

† The sex of two is surmised on difference of size. The wings were not measured in these two. The wing of all the S. I. birds is given as above from Baird's average.

‡ The two first were young of the year.

It appears from Mr. Henshaw's measurements, in his report for 1873, that Arizona specimens of *T. nanus* average smaller, and he remarks on the contrast in size between them and var. *Audubonii*, as seen in Colorado, much larger than *T. ustulatus*.

Although the nest and eggs of this variety may have led to its correct affiliation with "*Swainsonii*," they are not always reliable in this genus, if Dr. Coues is right in stating that *T. fuscescens* sometimes lays spotted eggs, and builds either on the ground, in bushes, or in trees! (Birds of the Northwest, 1874). If a few more of the best marked distinctions become broken down by future observations, we may yet find that all the six races now divided into two or three species must be combined in one (a "*T. parvus* Seligmann, 1775"?).

T. Aliciæ? Baird—Alice's Thrush—In a note given by me in the "Nat. Hist. of Wash. Terr.," 1860. Zool. p. 171, I stated that I had seen two thrushes there in December and March, quite unlike *ustulatus*, which I then knew to be a summer visitor only. I compared them to Wilson's plate of "*solitarius*" (var. Swainsoni ?), and Swainson's of "*minor*" (var. Pallassi ?), but neither is at all likely to winter so far north. "Their color was a very dark brown, without a tint of olive, and the breast more thickly marked with spots of the same color, large and round." This agrees so nearly with Baird's description of the winter plumage of *Aliciæ* (then unknown), that they may be considered either to have been Alaskan specimens of that bird (not since seen in the U. S. in winter), or stragglers from Asia of a foreign species.

Harporhynchus redivivus—California Thrasher—p. 16. Eggs laid in a nest at Saticoy, Ventura Co., May 26th, hatched in 13 days. The length given in the text referred to, as 1.10, should be 1.20. The iris, colored yellow in many copies of the Cal. Ornith., is really brown, as in all the Californian species.

Polioptila cœrulea—Blue-Gray Flycatcher—p. 35. Can this be the "*Sylvicola cœrulea*," quoted by Townsend and Audubon from the Columbia River? That species is not now found west of long. 100°, while the above migrates north as far as the southern branches of the Columbia at least.

Lophophanes inornatus—Plain Crested Titmouse—p. 42. A curious relationship to *Chamæa* is shown in the tail-feathers of this species, which, under oblique light, show many dark bars above, as in that bird. The same character has recently been ascertained in *Melospiza*, and is quite apparent in some of var. *Heermanni*: also in species of *Peucæa*.

Salpinctes obsoletus—Rock-Wren—p. 64. The eggs described were so much more reddish than authentic examples from farther south described by others, that they may have belonged to the western House-Wren.

Thryothorus spilurus—Bewick's Wren—p. 69. The nest described was so different from that of *T. Bewickii*, that I was induced to consider the bird a distinct species; but as I find that northward it builds in hollow trees, houses, etc., I must suppose that it merely took some other bird's old nest, for want of such accommodations.

Troglodytes (ædon, var.) Parkmanni—Western House-Wren—p. 71. The references to "*T. Americanus* Aud." as from Oregon, by Audubon, Gambel, and Nuttall, were no doubt based on this variety, which is of about the same size, and was not distinguished until five years years later. Gambel, in re-

naming it *T. sylvestris*, had reference apparently to the name "Wood-Wren," given by Audubon to "*T. Americanus*." The latter author and Nuttall both considered it nearest to *T. hyemalis*, instead of *T. ædon*, from which confusion resulted; and Dr. Heermann, in quoting *T. Americanus* from California, as well as *T. ædon*, seems to have meant the American race of the "European Wren" (*T. Europæus* Cuv.), which is *T. hyemalis*. I have seen the latter recently just north of S. F. Bay, near the sea-level, in Sept., and down to lat. 35° from Nov. to March.

HELMINTHOPHAGA CELATA—Orange-crowned Warbler—p. 83—(var. *lutescens* Ridgw.). The nest and eggs described by Audubon, as quoted by me, must have belonged to some other bird. On May 25th, 1874, I found a nest near Haywood, Alameda Co., built on the ground among dead leaves, on a steep slope in the woods, very similar to that of the eastern variety found by Kennicott, and I shot the female for identification. The three eggs, probably a second brood, are clear white, densely spotted with brownish-red specks; size 0.50 by 0.60 inch. They were partly hatched, and probably a second brood.

DENDRŒCA AUDUBONII—Audubon's Warbler—p. 88. This species, having the greatest adaptability to different climates and foods, far outnumbers all the others. In winter I have seen them pecking at dough and other food thrown out of doors, besides fruit-skins, and green herbage.

DENDRŒCA CORONATA—Yellow-crowned Warbler—p. 89. A female of this species was killed in Oakland, Cal., in the winter of 1872–3, and I shot a very perfect male at Haywood, April 10th, 1875. As they winter as far north as New York, those of this coast may spend that season chiefly north of the U. S., or in the mountains. The nest and eggs, as quoted from Audubon's description, are considered by Dr. Brewer as belonging to some other bird—(See N. A. Birds, I. 228).

DENDRŒCA TOWNSENDI—Townsend's Warbler—p. 91. I saw one of this species at Haywood as early as Sept. 12th, 1875, in company with several of our summer warblers; so that it is probable that some of the species may breed not very far to the north. I saw no more until Dec. 5th.

GEOTHLYPIS TRICHAS—Yellow-Throat—p. 95. As I suspected, this species winters in great numbers in California, between lats 38° and 35°. I found a nest near Saticoy, Ventura Co., containing young on Apr. 22d, nearly as early as I before recorded them as migrating near San Diego. I have seen none in summer in the windy region around S. F. Bay, though a few winter there.

MYIODIOCTES PUSILLUS—Black-capped Warbler—p. 101—(var. *pileolatus* PALLAS). Although described by Baird in N. A. Birds, I. 319, as having a shorter wing and tail than the eastern var., the measurements and remarks in Pacific R. R. Rep. (Birds IX, p. 293) indicate the contrary, as well as larger size, according to the usual rule in west coast varieties.

As suggested by me, the arrival of this species in California is usually much earlier than observed in 1862, as I found them in 1873 near Saticoy, lat. 35°, on March 18th, the males migrating north in large numbers, and singing

much like *D. æstiva*. I no doubt mistook them for that species at Puget Sound in 1854, reaching there by Apr. 10th, as mentioned in Zoöl. of Wash. Terr., p. 182. I now find that they are a month earlier than that bird in California.

In May, 1875, I found a nest of this species built about four feet from the ground in a thicket of nettles at Haywood, Alameda Co. It was neatly formed of vegetable fibres and grass-leaves, 3½ inches wide, 2½ high, the inside 2½ wide and 1¼ deep. The three eggs measure 0.68 by 0.52 in., a little larger than those described by Dr. Brewer, and are white, with a scattered ring of brown specks near the large end. As this bird breeds so far north, and to the summits of the highest mountains where wooded, its frequency in so warm a locality in summer is surprising; but in 1873 I saw them feeding young at Saticoy, lat. 35°, which is, however, less inland and about as cool. The prevalence of the sea-breeze in summer makes the climate of the coast border within fifteen miles very much like that of the mountain summits at that season.

Vireosylvia gilva—Warbling Vireo—p. 116, (var. *Swainsoni* Baird). This bird seems to arrive much earlier than noticed in former years, as I found them at Haywood, Alameda County, near lat. 38°, by March 31st, 1875, while the date noticed in 1862 at San Diego, was April 10th, and at Santa Cruz, May 9th. Like several other birds, those that go inland appear to come earlier than those traveling along the coast; or, from being more common, their first arrival is more easily observed.

Ampelis garrulus—Arctic Wax Wing—p. 127. The locality of my specimen, although doubted by some recent authors, may be verified by inspection of the original in the University of California, where it has been for a long time comparable with native specimens of *A. cedrorum*.

Pinicola canadensis—Pine Grosbeak—p. 151. A specimen which I shot in August, 1870, near the summit of the Pacific R. R. Pass, over the Sierra Nevada, was of a fine *orange-red* color, but beginning to moult. This plumage, which is not described by Baird, is stated by Nuttall to be the most adult condition of the species, the *carmine-red* characterizing younger birds. It may, however, be a fading change, like the yellow seen in caged birds of some other red species.

Chrysomitris tristis—American Goldfinch—p. 167. The size of the eggs given by me is so much smaller than of Eastern specimens, that Dr. Brewer seems to think it wrong. I have, however, found them at Haywood even smaller, measuring only 0.60 by 0.50 inch, while I did not find either of the other species at Santa Cruz. Mr. W. A. Cooper thinks, however, that *C. Lawrencii* may breed there. At Saticoy I found eggs by April 25th, and at Haywood saw fledged young fed by the male on June 15th, so that they are not always so late in building on this coast as on the eastern. The eggs vary, as elsewhere, from white to pale bluish. This and the two next are called here, "Wild Canaries."

C. PSALTRIA—Arkansas Goldfinch—p. 168. This also, builds plentifully about Haywood, and the nests are not distinguishable, except in smaller size, from those of *C. tristis*, but built much earlier. Some were begun by March 1st, but finished slowly, only being worked upon when the day was warm. One was built in a rose-bush, not over four feet from the ground and close to the path, where we often looked at the female sitting on four eggs, which hatched in 12 days. The eggs here differ so much from those of *C. tristis*, that I doubt whether Dr. Brewer ever saw authentic specimens, they being much more bluish and less pointed in several nests which I compared, though one set was nearly white. I saw the first fledged young being fed by the parents, as early as April 30th. The males often breed in the same dull plumage as the females, and are all much less brightly colored in summer than in winter. Some of them at that season look almost black enough above for var. *Arizonæ*. Their flight is not undulating, like that of *C. tristis*, but with a weak fluttering motion of the wings; nor do they have a flying song, like that species. In March and April, these birds join with most of the other smaller birds in feeding on the caterpillars, which then swarm so thickly on the oaks as to destroy every one of the first growth of leaves. Though a new growth succeeds, there are some trees kept bare the whole summer, or stripped by successive broods of caterpillars.

C. LAWRENCII—Lawrence's Goldfinch—p. 171. I have recently seen this species near San Francisco in winter very rarely, and I did not see any at Santa Cruz or Monterey even in summer. They reach S. F. Bay in large numbers after March 20th, and scatter through the oak-groves in pairs, building early in April, chiefly in low branches of the live-oaks. Recently, some have begun to build in gardens, chiefly in cypress and other evergreen trees, where I found several nests. The eggs I find more elongated than those of *C. psaltria*, being 0.65 by 0.48 inch, and *pure white*. They were hatched in about 12 days, and in 12 more the young left the nest, following the parents with the same cry of "she-veet" as those of *C. tristis*, but as with *C. psaltria*, the flight of adults is without cry or undulations.

C. PINUS—Pine Goldfinch—p. 172. In 1874, I found that this bird is a summer resident in the cool foggy pine woods near Monterey, probably the only point suited for it at that season south of lat. 40° on this coast. I saw them there, building a nest in a high pine, in June. They come about San Francisco and Santa Cruz in small numbers in winter, and I shot one at Haywood as late as April 10th, 1875, where a few were with other species feeding on the caterpillars which then swarmed on the oaks. There are no coniferous forests about this place to attract them. They fly so much like *C. tristis* as to be easily mistaken for them in winter, but the only species that has the peculiar sharp note like "svéer" uttered by this species, is *C. Lawrencii*, which is also much hoarser in its song than the others.

PASSERCULUS SANDWICHENSIS—Alaska Sparrow—p. 180. Although late authors have made this a variety of *P. savanna*, it must claim the typical place by right of priority, while "*Emberiza arctica*" Latham 1790, may prove to be founded on the more eastern "*P. princeps*" Maynard 1874. "*E.*

chrysops" Pallas 1811, is also preferable to *savanna* Wilson, who seems to have given the name by mistake for the doubtful "*E. savanarum*" of Gmelin. If *Sandwichensis* is retained, there can be little doubt as to adopting also Gmelin's "*Turdus Aonalaschkæ*" founded on the "Aonalaska thrush," as this was called the "Sandwich or Aonalaska Bunting." The chances for confusion to have arisen in Gmelin's classification, are more than two to one in this case of the Bunting, above those likely to occur in his naming a bird *Turdus*. (See *T. nanus*).

P. (S. var.) ALAUDINUS—Skylark Sparrow—p. 181. The original type of this variety was from "California" (probably Bodega), and therefore represents the race so near var. *savanna*, which was first identified with it by Prof. Baird, and *not* the more inland, paler and smaller race, which he has so named in his latest work. As, however, all the races are admitted to intergrade together, it is perhaps not improper to give the name to the extreme variety, and to consider the California birds as linking it with var. *anthinus*, which seems to be his latest opinion. The measurements I gave from fresh specimens, as well as the new figures of heads given by him in N. A. Birds, show how uncertain are characters based on size to distinguish even the local races.

P. (S. var.) ANTHINUS—Titlark Sparrow—p. 183. Though Bonaparte's type was said to be from Kodiak I., Alaska, Prof. Baird has only recognized one young bird "of var. *Sandwichensis* approaching var. *anthinus*," from there, and none from the main-land of Alaska, referring all to var. *alaudinus*, including Dall's "*P. savanna*," which merely goes to show that the original type was not a very extreme form.

In 1872-3, in Ventura Co., I again observed the limitation of this variety to the salt marshes while an upland race frequented the dry, grassy hills along the cool sea beach, but not six miles inland, in summer. I found no nests, but shot a young bird newly fledged, of the latter variety, in July, which resembled closely the young of var. *savanna* described by Baird in his last work.

P. ROSTRATUS—Long-billed Sparrow—p. 184. The approach of this species to the genus *Ammodromus*, recognized by Cassin and confirmed by its habits, shows that *Passerculus* (as well as *Coturniculus* and *Centronyx*) is scarcely more than a division of that genus, though "*A. Samuelis*," p. 191, is now admitted to be a *Melospiza*. *P. rostratus* represents *A. maritimus* on this coast, while *P. anthinus* is the analogue of *A. caudacutus*. The young is thickly spotted on the breast like that of *A. maritimus*, and like the more southern variety *guttatus*. On May 26th, 1862, I found a nest among sand-hills close to the beach at San Pedro, built like that of *P. savanna*, and containing two eggs, whitish, thickly speckled nearly all over with brown. Though I did not see the bird, there was no other in the vicinity that was likely to have owned them except this species. Mr. Dunn has since found a nest at San Diego, two feet up in *Salicornia*, and with three such eggs, measuring 0.80 by 0.60.

CHONDESTES GRAMMACA—Lark Finch—p. 193. A few of this species winter

near San Francisco, where I saw them in the middle of January, 1875. The occurrence of this species farther east than formerly, some even to the Atlantic coast, seems to show that the denudation of the greater part of the Appalachian forests, is producing the effect of making that country so much better suited to the habits of birds of the great western plains, that they are gradually moving eastward. This migration, commenced by the Cliff Swallow in 1811, is now noticed in the Yellow-headed and Brewer's Blackbirds, the Magpie, Arkansas Flycatcher, and several others more fond of the forests, most of which could not have been overlooked by the old observers.

GUIRACA CŒRULEA—Blue Grosbeak—p. 230. In 1873, I saw the males of this species migrating north in small parties through Ventura Co. on April 17th, so that they come earlier along the coast than at Ft. Mojave. On the same day the allied *Cyanospiza* was migrating, as usual, in flocks, together with *Dendrœca æstiva*. In 1875, the two latter reached Haywood, Alameda Co., April 20th; but the Grosbeak seeks a more inland route toward the north. The arrival of most spring birds is varied a week or two by the winds and weather, as a few warm days and south wind always bring them in large flocks, when the contrary conditions either delay them all, or make them arrive in scattered order. The prevalence of fogs for 20 miles inland during many nights of spring also changes the route of some or all the migrants.

AGELÆUS TRICOLOR—Red and White-shouldered Blackbird—p. 265. The eggs of this bird, instead of being like those of Brewer's Blackbird, as I quoted from Dr. Heermann, are almost undistinguishable from those of the other Redwings. Dr. Brewer calls them deeper blue; but many found by me at Saticoy, Ventura Co., are rather pale green, with few dark brown blotches and lines near the large end. The nest differs more, being of straws, stems, and leaves, twisted around several upright stems of nettles, about four feet from the ground, and in the forks of the plants. They are about 7 inches high, 5 wide, inside 3 by 3, with a fine grass lining. Hundreds built in one nettle thicket, around a marshy spot, but none in the cat-tails or rushes near by. The nettles were a protection from raccoons, etc.

CORVUS (AMERICANUS var.) CAURINUS—Western Crow—p. 285. Prof. Baird still insists on the specific distinctness of this form, as found from the Columbia River to Sitka, returning all Californian specimens to *C. Americanus*. The differences now first given by him are, "tarsus shorter than the bill, 1st quill longer than 10th, gloss deeper," besides the smaller size. But the plates in his former work, and the tables given with them, do not show such a constant difference in bill and tarsus as "culmen, 1.95; tarsus, 1.70," nor do they show any marked disproportion in the wings or tarsi of the two "species." The var. *Floridanus* is quite as peculiar in having larger bill and tarsus, but many intermediate specimens, some of which I myself collected at Ft. Dallas, Fla., connect it with *Americanus*.

In the same way the California birds connect the var. *caurinus* with *Americanus*. In his former work, Prof. Baird himself mentions the less graduated tail of Californian skins, and includes in *caurinus* several northern specimens of intermediate sizes.

Finally, the eggs show a regular gradation between the smallest northwestern and largest Floridan. The most peculiar habit of northwestern birds is that mentioned by J. K. Lord, in the close resemblance of their nests to those of the magpie. But as they do not build such nests near the mouth of the Columbia where no magpies are found, I have no doubt that those he saw thus used had been stolen from the magpies by the stronger crows.

PICA? (PICA var.) NUTTALLI—Yellow-billed Magpie—p. 295. This variety or race of the circumboreal *Coracias Pica* Linn. 1735, is not common near Monterey, as was stated on authority of Dr. Canfield, as I saw only two or three pairs within six miles, and a native of the place told me he had not seen so many before in thirty years. They are, however, great wanderers, like the other races, and may reside a few years at a place which they afterwards desert for a longer or shorter period. I have been told that they were formerly numerous in places where none are now found, and in 1855 I found them common twenty miles nearer San Francisco, to the south, than they were in 1873, when I saw none nearer that city than sixty miles in any direction.

One reason may be the reckless scattering of poisoned grain by the farmers to destroy squirrels, which has also destroyed the quails and numerous small birds, besides driving off or killing the crows and jays. But, on the other hand, in 1860 I found the var. *hudsonica* numerous at Ft. Vancouver, Columbia River, where I saw none in 1853-4, but where Townsend and Nuttall saw a few also in 1834. The high cold winds are sufficient cause for their permanent absence from near S. F. Bay, where several other birds are equally absent for the same reason, especially those of non-migratory habits.

CYANURA STELLERI—Steller's Jay—p. 298—(var. *frontalis* Ridgw. 1874). I found a few of these birds breeding in the dense pine woods at Monterey in 1874, and shot a young bird of the year in July, 1875, about 25 miles east of San Francisco, which had probably been raised in the redwoods at least 12 miles distant.

CONTOPUS BOREALIS—Olive-sided Flycatcher—p. 323. The statement by myself that this bird is "resident" north of Monterey is not confirmed by late observations, though I have never seen any migrating through the southern part of California, which ought to be as well suited for them in winter as Texas. If they fly from one pine-clad range to another when migrating, without stopping on the way, their journeys must be long and far to the eastward.

CONTOPUS RICHARDSONII—Short-legged Flycatcher—p. 325. Although most late authors rank this as a western race of *C. virens*, they do not mention intermediate specimens, and the differences, from their own accounts, appear quite marked. This has the wings longer and more pointed, feet larger and stouter, darker back, no light space on breast, more forked tail, and different notes and habits. Both breed in Texas and both winter in Central America, apparently without mixing. The two species are as different as *C. borealis* and *C. pertinax*. The western bird, though ranging to Wisconsin, can scarcely be supposed to reach Labrador habitually, and it now appears that Audubon's description of the nest and eggs found there was entirely incorrect, answering better to that of some warbler.

EMPIDONAX (PUSILLUS var.) TRAILLII—Traill's Flycatcher—p. 327. I have no doubt that the Colorado valley specimens mentioned were of this race, though the differences between it and var. *pusillus* are now narrowed down by intermediate specimens to a more brownish-olive color, and darker wing-bands, shorter tail and tarsus. I have since found other specimens connecting them not uncommon in Ventura Co., where I saw none until May 22d, when their peculiar notes became noticeable. These differ from any I have ever heard uttered by the true *pusillus*, which is an abundant species in the north, and was only by accident omitted in my published report on Cal. Ornithology. The whole description of its nest, eggs and habits was by a blunder inserted under *E. Hammondii* on p. 331, from line 9 to 28, which species was reported by Baird, from Monterey.

E. (FLAVIVENTRIS var.?) DIFFICILIS.—Yellow-bellied Flycatcher—p. 328. The western race of this species proves to be really more different from the eastern than that of the preceding, and especially in laying spotted eggs, which, indeed, scarcely differ from those of *E. pusillus*. If the allied *Sayornis* (and some other birds) did not show a similar, though less marked, variation in its eggs, independent of regional variations in plumage, we might decide from this the question of identity, but there seem in this case, also to be intermediate birds. At Haywood, Alameda Co., I found about twelve nests and captured enough birds on them for certainty. All were built in the hollows outside or inside of stumps and trees from two to ten feet above ground, or against the walls of little caves in rocky banks, and two on timbers under sheds. Mud is used for the shell, covered outside with much green moss and lined with fine grass, fibres, etc., thus being quite different from that of the eastern bird as described.

The eggs varied a good deal in size and form, usually being larger than those of *pusillus* from Santa Cruz, length 0.73 to 0.62 by 0.58 to 0.52. Even when under sheds the green moss was liberally used, making the nests even more conspicuous than without it. This was the only species I found breeding near Haywood, and it arrived there March 31st, though I found them near Santa Barbara by the 21st, in 1873, three weeks earlier than noticed at San Diego. The differences in the two races seem to be wholly in shades of color and size, not in proportions, as formerly supposed, when young autumn specimens of var. *difficilis* were the types described.

CHÆTURA VAUXI—Oregon Swift—p. 357. Arrived or passed through Ventura County, northward, on April 22d, 1873, and through San Diego on April 26th, 1872. As this is now considered the western race of *C. pelagica*, and winters on the west slope of Central America, the undecided question as to where the eastern birds winter, suggests that they may either be the "var. *poliura*," of South America, or the species mentioned by Nuttall, as follows: "The wonderful account of the swallow-roosts in Honduras given by Capt. Henderson, appears to be entirely applicable to this species." (Man. I, 738.) The *C. zonaris* or some other species may, however, be referred to. I cannot consider this bird a western race only of *C. pelagica*, as intermediate forms are still unknown.

CALYPTE ANNA—Anna Hummer—p. 358. This species though mentioned by Gould as Mexican, had not been detected in the intermediate territory of Arizona until 1874, when Mr. Henshaw obtained them there. Very few of the California birds, however, leave the State in winter, if any.

I have found eggs vary from 0.60 to 0.52 long, by 0.40 to 0.35, and the nests vary half an inch in depth, according to the degree of exposure to the wind of their locations. The amount of moss put on the outside also varies, from almost none to a complete covering, as no doubt is the case with those of other species. They lay eggs as early as Feb. 1st, in lat. 38°!

STELLULA CALLIOPE—Calliope Hummer—p. 363. A male of this species was shot at Haywood, Alameda Co., April 17, 1875, the first yet found west of the Sierra Nevada, and no doubt a straggler.

GEOCOCCYX CALIFORNIANUS—Road-Runner—p. 368. At Saticoy, Ventura Co., I found a nest of this species built in a small Chilian pepper-tree (*Schinus molle*), growing in a hedge, containing two eggs, apparently deserted, on April 12th, 1873. It was only four feet above ground, and not much hidden, built of coarse sticks, with lining of straw and dry horse-dung. From seeing only Barn Owls about there, I supposed it to belong to that bird, the eggs agreeing more nearly with theirs in form than with the one I described, which was laid in a cage. From Dr. Brewer's account of the usual size and form of their eggs, I am, however, now satisfied that they belonged to this bird. The largest measured 1.55 by 1.20 inch. In the appendix to Dr. Brewer's work this nest is mentioned as a Barn Owl's.

PICUS (PUBESCENS var.) GAIRDNERI—Gairdner's Woodpecker—p. 377. This race of *P. pubescens* was in 1870 supposed to be absent from Southern California; but in 1872–3 I found it a common species in Ventura Co., lat. 35°, in the cool groves near the mouth of Santa Clara River, where it took the place of *S. Nuttalli*, a species more common in the warmer valleys farther inland. The specimens obtained are much nearer like the eastern race than those from the north.

I must here remark that, from the too liberal use of the names of favorite saints by the Spaniards, it is necessary to explain that the river above mentioned is over 150 miles south of the "Santa Clara Valley" near San Francisco Bay, mentioned as the southern limit of this species (and elsewhere in Orn. of Cal., Vol. I), which is more often called San José Valley.

COLAPTES AURATUS—Golden-winged Flicker—pp. 410, 412. It is very remarkable that specimens differing from the eastern bird only in the black cheek-patches being tipped with red (which is reported also of Florida and New Jersey specimens), should occur close to the Pacific coast, where we would expect the characters of *Mexicanus* to predominate even in hybrids. On Nov. 21st, 1872, I shot a splendid male specimen near San Buenaventura, which can scarcely be supposed to have straggled from Alaska so far south, and, like those found near S. F. Bay, indicates some yet unexplained law of distribution. It was considerably smaller than those of *Mexicanus* shot in the same region, and probably not migratory.

The following shows the comparative sizes of these and of *C. chrysoides*, from Ft. Mojave, in same latitude:

C. AURATUS ♂; length 13 inches, extent 20.20, wing 6.35.

C. MEXICANUS ♂; length 13.75 inches, extent 21.40, wing 6.75.

C. CHRYSOIDES, ♂; length 11.75 inches, extent 19.25, wing 6.25.

The colors of iris, bill, and feet were alike, except in the last, which had the iris blood-red. It becomes again a question which of the yellow-winged species was Dr. Heermann's "*C. Ayresii*," from Cosumnes River, Cal.

In January, 1873, I shot a specimen of *C. Mexicanus* at the same locality, which attracted my attention by its pale orange-color under the wings. I found it not a hybrid, nor in any way intermediate, but a faded variety, such as is noticed in specimens of other woodpeckers from the hot, arid regions east of the Sierra Nevada. Though its plumage was fresh and not worn, its back was nearly white, with dusky bars, quills gray near ends, and other upper parts pale brown, marked as usual. It was evidently a migrant from the border of the deserts eastward, and showed that climate can have little to do with the characters of the two leading forms, or the intermediate race; which is further proved by the occurrence of two species in the Colorado valley, where no hybrids have so far been found.

The occurrence of *C. auratus* in Greenland and England makes its occasional straggling to California less remarkable; but is it not capable of naturalization here?

STRIX (FLAMMEA var.?) PRATINCOLA—Barn Owl—p. 415. Audubon's account of the nesting of this bird in the grass, though almost incredible, is not much less so than its building *underground*, as it occasionally does in California, selecting a cavity in a steep bank of earth along some stream, where the winter rains leave many such holes, perfectly dry for six or eight months of summer. I obtained five eggs from such a cavity, Apr. 10th, 1875, at Haywood, Alameda Co., where I also knew of nests in hollow trees, among branches, and in a wind-mill, whose owner wisely protected them. Bonaparte's specific name, implying a general residence in fields, was therefore badly chosen for this variety, for which the name *Americana* Aud., 1834, is also prior, and not mistakable for Gmelin's uncertain species. As this owl scarcely goes north beyond lat. 42°, and stragglers are not reported from the interval of over 3,000 miles between its range and that of *S. flammea*, an intermingling of the races must have occurred at a very remote period, if ever. In California it is resident in the northern half of the State all the year, and in winter its numbers are increased by migrants from the north, probably from as far as Oregon, where it was found by Townsend and Peale.

It would not be strange if this owl was found to enlarge its underground domicile when too small by a little burrowing, like the similar-footed but weaker Ground Owl, or as reported of the short-footed *Brachyotus* by Dall.

BUTEO SWAINSONII—White-throated Buzzard (of Nuttall)—p. 476. I shot the first specimen of the typical race recorded from California, on Oct. 2d, 1872, at Saticoy, Ventura Co. Nearly, if not quite all, breeding west of the

Sierra Nevada, are of the var. *insignatus*, while the pale race seems chiefly to prevail in the open and arid regions eastward. I found the dark race breeding down to San Diego, and they seem more common on this slope than the *B. borealis*, even to Alaska. They migrate in flocks, of which one was mentioned in the Orn. of Cal., going north in San Diego Co., April 18th, 1862, and on Apr. 16th, 1873, I saw a similar flock, entirely of *insignatus*, going north over Ventura Co. With the first were some of *Archibuteo* and other species. They returned south about Oct. 1, in Ventura Co., more or less in flocks, while no southward movement of *B. borealis* occurred until a month later. My statement that the average size of this species is equal to that of *borealis* was founded on a comparison of females of this with males of the latter. The wings are longer in proportion, which in dried skins is liable to mislead. The difference between wing and total length I found in six specimens to average only 3.72 inches, while in seven of var. *calurus* it averaged six inches. Although Dr. Brewer thinks that the nest and eggs described by Heermann as of *Archibuteo* belonged to this bird, the description of both seems to me more suited to the latter, which certainly breeds here.

BUTEO (LINEATUS var.) ELEGANS—Elegant Buzzard—p. 477. The description of the young which I copied from Cassin's, is wrong in giving 12 instead of 6 bars on the tail, no doubt inadvertently, as he figures it correctly in Birds of N. A. (P. R. R. Rep. X, pl. II and III). I saw a dead bird of this species in Marin Co., north of S. F. Bay in 1873, and it is doubtless the "*F. hyemalis*" of Townsend's Oregon list, as the eastern race goes north to Nova Scotia. In 1872–3, I found them constant residents of Ventura Co., and not more common in winter.

BUTEO OXYPTERUS—Sharp-winged Buzzard—p. 480. A specimen in Woodward's Museum, shot at San Diego in 1871, agrees perfectly with Cassin's plate, and I do not agree with Ridgway in considering it merely a variety of *B. Swainsoni*. Besides its smaller size, it appears to have more transverse scales on tarsus, and its wing is different, both in proportions of quills and length. The dark var. *fuliginosus* is also said to differ from *insignatus* in sooty tint, no white on forehead, under-wing coverts banded white, tail cinereous umber, with seven (not ten) bars. Other differences are noted in the Central and South American specimens, described by Ridgway. Of its relation to *B. Pennsylvanicus*, suggested by J. A. Allen, I cannot decide.

ELANUS LEUCURUS—Black-shouldered Hawk—p. 488. Mr. Ridgway's belief that the Australian birds are specifically identical, will make this the *E. axillaris* Latham (1801), var. *leucurus*, but any inter-migration of specimens between the two continents since the pliocene epoch, is more difficult to suppose than in the case of the stronger-winged Barn Owl. Our bird does not seem to go north of lat. 39°, and none are recorded from western Asia. I have seen but one or two in Ventura Co., and none south of lat. 35°, so that the California birds seem to be constant residents in the middle region of the State, where only their favorite marshes are extensive.

ORTYX DOUGLASSII—Vigors, 1829. This is, apparently, merely a newly fledged young California Quail. The locality given, "Monterey, Cal.," goes to confirm this view, and I have found the first plumage agree closely.

J. P. Dameron stated that he had been experimenting on the propagation of Oysters and would shortly describe a method discovered by himself.

Mr. Scupham read a paper suggesting that steps be taken by the Academy to assist in bringing about the resumption of the Geological Survey.

On motion of Mr. Scupham, a Committee was appointed to examine into the matter and report at the next meeting. Messrs. Scupham, Blake and Ashburner, were appointed as such Committee.

Mr. Stearns made the following remarks on the death of Hon. B. P. Avery:

Mr. President and Members of the Academy:

Since our last meeting the telegraph has brought us sad news —information of the death of our fellow-member, the Hon. Benjamin Parke Avery, United States Minister to China, who died in the early part of November at the city of Peking.

The many excellences of the deceased, the co-operative spirit which he ever manifested in all matters pertaining to the welfare of his fellow-men—quietly, because he was singularly modest and undemonstrative, yet nevertheless persistently pursuing the even tenor of what he considered his duty—and that duty the advancement of civilization in a new State, the promotion of knowledge, whether in Literature, Science, or Art—and the general refinement and elevation of the commonwealth in which he had made his home; such qualities and such services make it eminently proper that we should inscribe on the permanent records of the Academy an appreciative recognition of his life and labors, as well as an appropriate expression of our esteem, and of sorrow for his loss.

With the example of his unassuming but honorable career before us—too brief but yet well filled with useful work—it would be in discord with its harmony to expand these remarks into formal eulogy.

In a letter dated July 5th of this year, the last which I received, he wrote:

"Shut within the walls of our Legation, we are as much alone as if we were in one of the old glacial wombs of the Sierra Nevada—to think of which makes me sigh with longing, for was I not born anew therefrom, a recuperated child of Nature? Your letter with bay-leaves was right welcome, and gave me a good sniff of Berkeley. It was pleasant to receive the University bay, although I am not an Alumnus, and can boast no Alma-Mater except the rough school of self-education."

The closing line above his autograph is "O, California, that's the land for me!" Enclosed with his letter were a few plants collected by him upon the broad summit of the mouldering walls which surround the ancient city where he died. Our friend has gone! He has found the tranquillity of the grave in a country remote from his native land—from the California he loved so much; far from those he loved and the many who knew and loved him, and who would have deemed it a privilege to have been near him at the final moment, and to have mingled their last farewells with his. The particulars of the closing scene have not yet been received. We may be sure, however, that he looked into the future without fear, and faded serenely, as the twilight sinks into night.

Those who knew him best, and who enjoyed the precious freedom of intimacy, will tell you that his life was conspicuous for its purity—his character for its many virtues—his intellect for its refined and delicate culture—his heart for its tender and generous sympathy. The possession of these qualities endear a man to his fellow-men; they constitute a charming whole whose priceless web is woven from the choicest graces of our poor humanity; they form an enchanted mantle whose shining folds hide the poverty of human limitations.

So lived and walked our friend among us, crowned with the affection and respect of all who knew him. I do not say that he was perfect, and yet if fault he had I know it not, nor never heard it named.

Here let us rest—grateful that so true a life has been a part of ours. We place our tribute on his grave, and say good friend —farewell!

Resolved, That the California Academy of Sciences has learned with profound regret of the death of the Honorable Benjamin Parke Avery, a fellow-member and late United States Minister at the Court of Peking; that we

hereby recognize and express our high appreciation of his many private virtues and public services.

Resolved, That these resolutions be spread on the records of the Academy and published in the proceedings.

REGULAR MEETING, DECEMBER 20TH, 1876.

Vice-President Edwards in the Chair.

Thirty-five members present.

Donations to the Museum were as follows: Thirty-three specimens of Scorpions from Arizona, from Dr. R. K. Nuttall; also from same donor, one crustacean and one sceloporus. F. Gruber presented a fine specimen of *Cervus Mexicanus*, mounted; *Rhaphidophora subterranea* from Mammoth Cave, Kentucky.

The Nominating Committee appointed by the Council and Trustees presented their report, nominating officers for 1876, as follows:

PRESIDENT.

GEORGE DAVIDSON.

FIRST VICE-PRESIDENT.	RECORDING SECRETARY.
HENRY EDWARDS.	CHAS. G. YALE.
SECOND VICE-PRESIDENT.	TREASURER.
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CORRESPONDING SECRETARY.	LIBRARIAN.
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DIRECTOR OF MUSEUM.

W. G. W. HARFORD.

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GEORGE DAVIDSON,	WM. ASHBURNER,
THOS. P. MADDEN,	GEO. E. GRAY,

R. C. HARRISON.

Charles Wolcott Brooks, of the Nominating Committee, read a statement giving their reasons for having nominated certain of those upon the ticket presented.

On motion, the report of the Committee was adopted and the Committee discharged.

Mr. Scupham, of the Committee appointed on the question of the continuance of the State Geological Survey, reported a Memorial to be transmitted to the State Legislature, asking them to revive the Survey. The Memorial was as follows:

MEMORIAL.

To the Honorable, the Senate and Assembly of the State of California:

The California Academy of Sciences would respectfully represent that the Geological Survey is a work of great practical importance, as well as scientific and educational value, to the people of this State.

That by the action of the Legislature of 1873–74, the accumulated and unpublished material of several years' work was placed for safe keeping in the custody of the Regents of the University, where, for want of further provision, the greater portion still lies unimproved.

That there have been already published four volumes of the geological reports, viz.: one of geology, two of paleontology, and one of ornithology, besides smaller pamphlets, and several topographical maps, the beauty, accuracy and value of which are appreciated and acknowledged by all who have carefully examined them.

That of the unpublished matter already accumulated, there is the material for a second volume of geology, for a volume of botany, nearly ready to be issued, and the greater portion of the material for a second volume of ornithology devoted to the aquatic birds.

That the map of Central California is so nearly finished that the active field work of one more season would complete it. This map embraces nearly one-half the area of the State, and extending from Lassen's Peak on the north, to Visalia on the south; includes all the more important mining districts within the limits of California. The work so far done upon it is unexceptionable, and when completed, it will possess the highest practical value, will meet with a ready sale, and be the most important contribution to the geography of this coast that has ever been made.

That a general geological map of the whole State has been partially drawn and colored, and could be finished and published in such a way as to show the extent of the present knowledge of the geology of the State (subject, of course, to such improvements in detail as may hereafter be developed by future work) at no great expense.

That the U. S. Coast Survey map of the peninsula of San Francisco has been geologically colored in great detail, and only waits the means for its publication.

Finally, that these unpublished works are greatly needed for the benefit of our public schools, as well as for all the higher educational interests of the State, and that when completed, they would convey the most accurate information with regard to our coal fields, quicksilver mines, quartz veins and hydraulic washings, which cannot fail to exercise a most beneficial influence in aiding the further development of these important industries.

In view of the foregoing facts, the California Academy of Sciences would respectfully pray that your Honorable Bodies revive the State Geological Survey, and make a liberal appropriation for its continuance and completion.

On motion, the Memorial was approved and ordered forwarded.

Charles Wolcott Brooks presented an additional or supplementary report from the Nominating Committee, substituting as one of the Trustees, Dr. Geo. Hewston in place of George Davidson, and stating that it had been considered questionable whether the President of the Academy could also serve as a Trustee.

Considerable discussion ensued upon the subject, and finally John F. Miller was elected as a substitute for Professor Davidson.

The following were elected Judges and Inspectors of Election: C. D. Gibbes and T. J. Lowry, Judges; R. S. Floyd and Samuel Hubbard, Inspectors.

[The following paper, read at the Regular Meeting held July 19, 1875, should have been printed in the Proceedings of that Meeting.]

Pacific Coast Lepidoptera, No. 14.—Notes on the Genus Catocala, with Descriptions of new Species.

BY HENRY EDWARDS.

The beautiful moths included in the genus *Catocala* are among the more interesting of the larger *Noctuidæ*, and appear to have obtained their fullest representation on the North American continent. They are natives, for the most part of the northern temperate zone, and though some are said to exist in the Hawaiian Islands, and I am acquainted with one very large species, (a mutilated example of which was collected by the late Baron Terloo, and presented to me by Dr. H. Behr) which comes from the table land of Mexico, near Guadalajara, still the United States, Japan, N. China, Siberia and Eu-

rope must be regarded as the home of the genus, the number of species in our own country far exceeding that of the whole of the other districts put together. According to Staudinger's last catalogue, thirty-four species are found in Europe and the adjacent territories, including Siberia, four or five are known to exist in Japan, and probably the same number in northern China, while the list of North American forms, including those mentioned in the present paper, has increased to no less than eighty-three species. In the islands of the southern Pacific and Australia are several genera which recall the coloration and structure of *Catocala*, but are separated from it by well defined limits, and it is almost certain that no true example of the genus is to be found in the southern hemisphere. Our northern States species have been recently admirably figured by Mr. H. Strecker, in his Lepidopt. Rhopaloc. et Heterocera, while Mr. A. R. Grote, of Buffalo, has published, in the Trans. Am. Ent. Soc., Vol. 4, 1872, descriptions of the whole of those then known to him. In Mr. Grote's valuable paper he has tabulated the genus as follows:

Section	1.	Secondaries black and unbanded above.	
"	2.	"	black above, with white median band.
"	3.	"	various shades of red, with black median band.
"	4.	"	orange above, with black median band.
"	5.	"	black above, with narrow yellow median band.
"	6.	"	yellow above, with median black band.
"	7.	"	yellow above, without median band.

It is somewhat remarkable that, with one exception, the whole of the Pacific Coast species at present known belong to the third section, viz., those which have the lower wings of various shades of red, sections one, six and seven being entirely unrepresented. The late Baron Terloo is said by Dr. Behr to have observed at San Jose, in this State, a specimen near to *Catocala relicta* (section 2) of New England, and I myself, last year, observed in San Mateo County a very large species, with pale yellow median band, evidently nearly allied to *Catocala cerogama* (section 6). It was sitting on the trunk of a large tree of *Œsculus californicus*, but to my great regret, evaded my attempt to capture it. I could not, however, be mistaken in the color of the under wings. It is quite probable that among our oak groves many species unknown to science exist, and we may confidently hope that those of our coast now enumerated will be at least doubled in the course of a few years. It may be well to notice that these insects come readily to sugar, Mr. G. Mathew, of H. M. S. *Repulse*, being so fortunate as to capture no less than 27 specimens of *C. Aholibah*, Streck., in a single night, on some oak trees prepared by him at Esquimalt, Vancouver Island.

The following are the species at present known to inhabit the Pacific Coast:

Section 3.

Catocala californica. W. H. Edwards, Proc. Ent. Soc. Phil., Vol. 2, 1864.

"Expands $2\frac{3}{10}$ inches.

"Primaries, dark brown, with a gray tinge, the transverse lines rather indistinct, the elbowed line with two teeth, equally prominent, and otherwise

resembling *C. Marmorata*, Edw. Beyond this is a brown band, bordered by a faint serrated, grayish line, which is edged without by black. Reniform, black; sub-reniform, brown.

"Secondaries, rosy red, nearly the same shade as in *Marmorata*. Median band, narrow, almost straight, contracting in the middle, and terminating abruptly two lines before the margin. Border somewhat sinuous towards the anal angle. Apical spot, white, tinged with reddish. Fringe long and white. On the under side of secondaries, the red shade occupies two-thirds of the wing. From Yreka, Cal."—W. H. Edwards, loc. cit.

I have two undoubted examples of this species, both, however in bad condition, one of which was taken near Prescott, Arizona, and the other at Carson City, Nevada.

Catocala Cleopatra. Hy. Edw. n. sp.

Primaries, dark bluish gray, powdered with brown atoms, transverse lines rather indistinct, slightly olivaceous; the t. a. edged with black exteriorly, and with the indentations rather small; t. p., delicately shaded with brown and olive, with two teeth on third and fourth nervures, strongly marked with black. Reniform, indistinct, olivaceous; sub-reniform, whitish, somewhat angular, its longest angle pointing outwardly; above it, and interior to the reniform, is a dull whitish patch; and above the reniform, and touching the costa, is a strongly marked brownish shade. Submarginal line, gray, whitish and broadest towards the apex. Fringes, white, with brownish scales, except where crossed by the nervures where they are black.

Secondaries, bright rosy red, with fawn-colored hairs at the base. Median band moderate; broadest in the middle, not toothed interiorly, and terminating two-tenths of an inch from the inner margin. Marginal band, not broad, except at the anterior angle, slightly sinuous as it approaches the inner margin. Fringes, broadly white, flecked with brown scales. Those of interior margin, long, dark drab, paler towards the base.

Under side. Primaries, white, with the usual black bands, the basal one oblique, shading into the median a little below the middle. Median, moderate, narrowest towards the posterior margin. Marginal band, broad towards apex, shading into fawn color at extreme margins.

Secondaries. Two-thirds of the interior portion, rosy red, as in the upper side, shading into white towards the anterior margin. Fringes, white, a little yellowish at anterior angle. Head and thorax dark gray, mottled with brown and olive scales, whitish on the disc, where the scales form an almost triangular white mark, edged posteriorly with a black line. Abdomen smoky brown above, paler beneath, and there dotted with fine brown scales.

Expanse of wings, 2.60 inch.

Length of body, 1.00 inch.

Berkeley, Contra Costa County, Cal. (One ♂. Coll. Hy. Edw.)

This species may be easily recognized by the bluish gray tint of the primaries, dashed with olivaceous, while the almost regular median band of secondaries, recalls the European *C. Pacta*, and the Atlantic and Canadian *C. Concumbens*, Walk. Like all our Californian species, it appears at present to be exceedingly rare.

Catocala Mariana. Hy. Edw. n. sp.

Primaries, dark iron gray, with bluish tinge, especially towards the margins. T. a., only slightly dentate, shading into black on the costa, and terminating on the interior margin in a whitish patch. T. p., commencing at about one-third the length of costa, then running outwardly into two strong indentations, marked interiorly with black, and towards the interior margin, sinuate into a long and narrow tooth, terminating in white patch on the interior margin. Sub-terminal, whitish. Posterior margins, paler gray, with a row of well defined black dots in the intro-nerval spaces. Reniform, blackish and indistinct. Sub-reniform, open, resting on whitish space. Fringes, dull white, mottled with brownish.

Secondaries, rose color, with basal hairs and fringe of anal margin brownish. Median band, moderate, constricted in the middle, forming rather a sharp angle outwardly near its center, which is its widest part. It does not narrow into a point at its termination, but ends abruptly about three-sixteenths of an inch from the abdominal margin. Marginal band, with deeper sinuations, but otherwise resembling the previous species. Fringes, clear white, very slightly mottled with brownish. Head and thorax, iron gray. Abdomen, smoky brown, paler beneath.

Under side, as in *C. Cleopatra.*

Expanse of wings, 2.50 inch.

Length of body, 1.00 inch.

Vancouver Island. Hy. Edw. and G. Mathew.

Closely resembling *C. Cleopatra*, and the Atlantic *C. Briseis*, but differing from the former by the darker color of the primaries, the duller and more scarlet red of secondaries, and by the less regular median band; and from *Briseis* by the broader band of secondaries, and by its abrupt termination far from the abdominal margin.

Catocala Faustina. Strecker. Lepid. Rh. et Heter., No. 3, Page 21.

"Male. Expands 2⅝ inch.

"Body above, gray; beneath, white.

"Upper surface. Primaries, bluish gray, powdered with brown atoms; marginal spots, transverse lines and bands, well defined. Reniform, distinct and surrounded by an outer circle, which is produced in two points on exterior. Sub-reniform, white; above this, and interior to the reniform, is a white space. Fringe, light gray.

"Secondaries, scarlet. Median band, moderately wide, angulated at center outwardly, and terminating somewhat abruptly about two lines from the abdominal margin. Marginal band, with a deep indentation between the first and second median nervules. Apical spot and emarginations, rosy. Fringe, on exterior margin, white; on interior margin, gray.

"Under surface. Primaries, white.

"Secondaries. Interior two-thirds rosy; towards costa, this color becomes lost in white; almost imperceptible indications of a discal lune."—STRECKER, loc. cit.

Arizona, Wheeler Expedition, 1871. Coll. H. Strecker. Dr. H. Behr, Nevada.

Catocala Perdita. Hy. Edw. n. sp.

Very closely allied to the last species, and, but for Mr. Strecker's assurance to the contrary, I should have considered it identical. The transverse lines, however, are heavier, and the reniform spot is more distinctly gray in color. The mesial band of secondaries is wider, and continued further towards the abdominal margin. The apices are pure white, without any tint of rose color, and the amount of red on the lower side is very decidedly less than is to be found in *Faustina.* In other respects I can perceive no difference.

San Mateo County, Cal. (Coll. Hy. Edw.)

Catocala Hippolyta. Hy. Edw. n. sp.

Primaries, pale silver gray, the whole of the lines brownish, distinct. T. a., shaded with dark, particularly on costa. T. p., with the teeth very regular, almost in a line with each other, and of equal length. Reniform, brownish, indistinct. Sub-reniform, whitish, not connected with the t. p. line. Subterminal line, with regular teeth, but pale and rather indistinct.

Secondaries, yellowish red, same color as in *Parta.* Marginal, broad on apex, unusually narrow towards abdominal margin, where are two deep indentations. Mesial band, exceedingly narrow, widest in the middle, terminating very abruptly about two-tenths of an inch from the margin. Apices and marginations, slightly rosy. Fringe, white. Under surface, as in *Perdita.*

Head and thorax, gray, mixed with white. Abdomen, pale grayish drab.

Expanse of wings, 2.75 inch.

San Mateo County, Cal. (Coll. Hy. Edw.)

This is a beautiful and strongly marked species, the very pale gray of the primaries, and the remarkably narrow mesial band of secondaries, serving to distinguish it from any other with which I am acquainted.

Catocala Luciana. Hy. Edw. n. sp.

Primaries, brownish, gray, with yellowish tinge; the whole of the lines and spots very heavy and strongly marked, shading into black on the margin. Reniform, large, blackish, surrounded by paler ring. Sub-reniform, distinct, open, fawn drab.

Secondaries, yellowish red, color of *Parta.* Marginal band, rather narrow and regular, with only slight indentations near abdominal margin. Mesial band, also narrow, widest in center, and terminating abruptly about two-tenths of an inch from abdominal margin. Apices, with an orange tint. Fringe, yellowish white.

Under surface, yellowish white; inner half of secondaries, red; the bands, all narrow.

Expanse of wings, 3.00 inch.

Colorado, T. L. Mead. (Coll. Hy. Edw.)

Catocala Irene. Behr. (Trans. Am. Ent. Soc., 1870.)

Primaries, yellowish brown, paler along the margins. The lines are all indistinct, and lost in the brown shading of the wings. T. a., almost obsolete.

T. p., with two deep teeth, above the middle, directed towards the apex, and surmounted by a blackish shade. Sub-terminal line grayish, with regular teeth. Reniform, small, brown. Sub-reniform, almost obsolete, connected with a paler shade, which touches the costa.

Secondaries, yellowish scarlet, color of *Unijuga*. Marginal band, moderate, rather deeply toothed towards abdominal margin. Mesial, rather narrow, slightly constricted in the middle, and terminating in a point about one-eighth of an inch from margin. The under side of secondaries has an unusually large proportion of red.

Expanse of wings, 2.60 inch.

Fort Tejon, Coll. Br. Behr. Mendocino Co., Cal., Coll. Hy. Edw.

Mr. Strecker expresses some doubts as to the identity of my specimen with Dr. Behr's species, (Lepid. Rhop. et Heter., page 100) but, upon again carefully comparing them, I am convinced that they are alike, and in this opinion I am sustained by Dr. Behr. The species resembles *Unijuga* in the color of the secondaries, but it is much smaller, and is very widely separate in the ornamentation of the superior wings, which are browner and more confused than those of its Atlantic relative.

Catocala Marmorata. W. H. Edwards. (Proc. Ent. Soc. Phil., Vol. 2, 1864.)

"Expands 4 inches.

"Head and thorax, light gray. Abdomen, wanting.

"Upper surface. Primaries, pale gray and white, more or less powdered with dark gray or blackish atoms, and bear a superficial resemblance to the European *C. Fraxini*. Transverse lines, black. Beyond the t. p. line, a brown band, succeeded outwardly by another, which is much narrower, and pure white. Reniform, dark, and shape not well defined. Sub-reniform, joined by a line to, not formed by, a sinus of the t. p. line. Fringe, white.

"Secondaries, scarlet, of a lovely shade. Mesial band, narrowed in the middle, and extends almost to the abdominal margin. Fringe, white.

"Habitation, Yreka,, Cal."—W. H. Edwards, loc. cit.

Of this grand insect, apparently the largest of all known American species, I am entirely ignorant, save through the above description and Mr. Strecker's admirable illustration.

Catocala Stretchii. Behr. (Trans. Am. Ent. Soc., 1870.)

Primaries, silver gray, very distinctly mottled with black irrorations. Lines, all faint. T. a., whitish, and with very small teeth, running its length almost straight and without deviation. T. p. also nearly straight, and with even indentations. Reniform, blackish, with a double ring. and surrounded by a dark cloud. Sub-reniform, whitish, with a fawn-colored tinge; rather small but very distinct. Sub-terminal line runs parallel to the t. p.

Secondaries, yellowish red, paler than in *Parta*. Mesial band, very narrow, scarcely constricted in the middle, and turning into a very distinct hook. about two-tenths of an inch from the abdominal margin. Marginal band nar-

row, with two small indentations near anal angle. Apices and marginations, very broadly white.

Thorax, gray. Abdomen, smoky drab.

Under side with usual bands, and half the secondaries yellowish red.

Expanse of wings, 2.85 inch.

Virginia City, Nevada, R. H. Stretch. (Coll. Dr. Behr.)

A very distinct species, of which the specimen in Dr. Behr's collection is the only one known to me. No other species has the hook of the mesial band so distinct as this, and the lines of the primaries are more regular and parallel to each other than in any other with which I am acquainted.

Catocala Aholibah. Strecker. (Lepid. Rhop. et Heteroc., Page 72.)

"Expands 3 inches.

"Head and thorax above, dark brown, with scattered white and gray scales. Abdomen, brown. Beneath, light brownish gray.

"Upper surface. Primaries, dark brown, frosted, and intermixed with white and gray; a white space adjoining the reniform, inwardly; reniform, indistinct; sub-reniform, very small, white, surrounded with black, and entirely disconnected with the transverse posterior line. Secondaries, crimson with brownish hair at the base; median band, rather narrow and regular, and continued to within a short distance of the abdominal margin, where it turns upwards, and is lost in the brownish hair that clothes that part.

"Under surface. Primaries, crossed by three black bands, none of which join or merge with each other; the spaces between the base and sub-basal band, and between the latter and the median band, are orange colored, inclining a little to crimson at the interior margin; the space between the median and marginal bands is white; fringe, white, with black at the termination of the veins. Secondaries, inner two-thirds, crimson, a little paler than on upper side; rest, white; marginal band, tinged with gray at and near the costa; median band terminates about one line from the abdominal margin; slight indications of a discal crescent, connecting with the median band; fringe, white.

"Habitation, California."—H. Strecker, loc. cit.

The above description was drawn up by Mr. Strecker from a ♀ presented to him by Mr. J. Behrens. The ♂, of which two specimens are in my collection, is smaller (2.60 inch.), the mesial band is wide, and reaches fully to the abdominal margin, while at the base of secondaries is a deep black shade formed by the hairs covering that region. The brown mottled shades of primaries are also much darker and richer, and the lines and spots more distinct.

C. Aholibah appears to be the most common of the Pacific Coast species, and is found from San Francisco to Vancouver Island, in which latter locality it is, as I have previously stated, quite abundant. It is by no means confined to the "higher mountains of California," as Mr. Behrens formerly imagined, that gentleman having recently taken a fine specimen at Saucelito, on the shores of our bay. I have received examples from Oregon and Washington Territory.

For the purpose of comparison, I am induced to add a description of the Mexican species spoken of at the commencement of this paper:

Catocala Cassandra. Hy. Edw. n. sp.

Primaries, dull gray, clouded with black. Lines, all distinct and regular. T. a., nearly straight, and with the indentations small. T. p., slightly bent on costa, with small and regular teeth, running obliquely from its center to interior margin, wanting the usual elbowed line, and reaching the margin behind its center. Sub-terminal line, almost obsolete. Reniform, black, surrounded by a black cloud, which reaches from costa to interior margin. Subreniform, whitish, indistinct.

Secondaries, pale red. Mesial band, narrow; of equal width for more than half its length, then abruptly narrowed, and bending almost at a right angle to abdominal margin. Marginal band, broad at the apex, with the indentations near anal angle moderate. Apices white, tinged with orange red. Fringe, white.

Under side. Usual bands, the mesial of secondaries terminating abruptly about two-tenths of an inch before reaching abdominal margin, and not continued to the margin as in the upper side. Inner half of secondaries, pale red.

Expanse of wings, 3.60 inch.

Guadalajara, Mexico, Baron Terloo. (Coll. Hy. Edw.)

Its large size, primaries clouded with black, and the peculiar form of the mesial band of secondaries, will serve to distinguish this from any other known species.

Section 4.

Secondaries, orange above, with black median band.

Catocala Zoe. Behr. (Proc. Ent. Soc. Phil., 1870.)

Primaries, rich brownish gray, mottled with white, the basal portion darkest. Across the center of the wing reaching from the base to the t. a. line, is a black dash, surmounted by some clear white scales. The t. a. is richly clouded with black, and only slightly dentate, chiefly towards the interior margin. T. p., black, with two large central teeth, and four smaller ones, of equal size, running towards the interior margin. The sub-terminal line is clear white, with the indentations small and regular. Reniform, large, whitish, surrounded by a double ring. Sub-reniform, very small in the ♂, large in ♀, open, and in the latter sex joining the t. p. line. Fringes, gray, mottled with brown.

Secondaries, bright orange, clouded at the base by brownish hairs. Mesial band, narrow, broadest in center, much constricted near abdominal margin, and there turned upwards, reaching the margin about its middle. Marginal band, moderate, very deeply bi-dentate near the anal angle. Apices and marginations, deep buff. Fringe, dirty white, alternated with brownish black.

Head and thorax, gray, mottled with white. Abdomen, smoky fawn color.

Under side. Usual bands, the lighter ones of primaries being largely suffused with orange, and the same color occupies nearly two-thirds of the secondaries.

Expanse of wings, 2.50 inch. ♂, 3.05 inch. ♀.

Napa and Marin Counties, Cal. Vancouver Island. (Coll. Dr. Behr. H. Strecker. Hy. Edw.)

This species very closely resembles both *C. Ilia* and *C. innubens* of the Atlantic States, but differs very materially from both in the pale color of the secondaries and by the more deeply toothed marginal band. The shading of the primaries very nearly approaches that of *Ilia*, but the lines are clearer, and more decidedly mottled with white.

It will thus be seen how very small is our present list of *Catocalæ*, compared with those of the Atlantic States, and yet, as the plants on which the caterpillars feed, viz., oaks, willows and poplars, are common throughout the State, we might reasonably look for an abundant harvest of species. Perhaps more collectors in the field, and a determined and energetic search for them in their haunts, will yield us a larger number of these beautiful moths, which at present, not alone in species, but also in individuals, may be ranked among the greatest of our entomological rarities. The following are noticed in this paper, the names of those which I have described as new having been derived from the heroines of Shakespeare's plays:

Catocala Californica	W. H. Edw.	
" *Cleopatra*	Hy. Edw.	n. sp.
" *Mariana*	Hy. Edw.	n. sp.
" *Faustina*	Strecker.	
" *Perdita*	Hy. Edw.	n. sp.
" *Hippolyta*	Hy. Edw.	n. sp.
" *Luciana*	Hy. Edw.	n. sp.
" *Irene*	Behr.	
" *Marmorata*	W. H. Edwards.	
" *Stretchii*	Behr.	
" *Aholibah*	Strecker.	
" *Cassandra*	Hy. Edw.	n. sp.
" *Zoe*	Behr.	

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OF THE

CALIFORNIA ACADEMY

OF

SCIENCES.

VOLUME VI.

1875.

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PROCEEDINGS

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VOLUME VII.

1876.

SAN FRANCISCO:

1877.

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PROCEEDINGS

OF THE

CALIFORNIA ACADEMY

OF

SCIENCES.

ANNUAL MEETING, JANUARY 3D, 1876.

First Vice-President in the Chair.

Thirty-seven members present.

Louis Nusbaumer and W. E. Burleigh were elected resident members.

On recommendation of the Council, Dr. Henry Gibbons, Sr. was unanimously elected an honorary life member.

In the absence of the President, First Vice-President, Henry Edwards, read the annual address as follows:

PRESIDENT'S ADDRESS.

It is a matter of regret that the coming of the New Year does not afford us the opportunity of welcoming back our worthy and respected President, who, on his return amongst us will doubtless have so much to say of the countries through which he has passed, and the many experiences which he has enjoyed. As circumstances will prolong his absence for a few weeks longer, it becomes my duty to address you on the progress which our Academy has made during the past year, and the hopes which

appear to be before us in the future. And the year which has just closed has indeed been for us an eventful one—the one from which, as it seems to me, our association will date its new life, and mark its strongest and most vigorous advancement. The Academy is poor no longer—the cloud of adversity which seemed so long to have overshadowed it, and which, but for the untiring energy and hopeful perseverance of a few of its members, would have brought its career of usefulness to a close, has, by the grand beneficence of one man, been entirely removed, and without indulging in too enthusiastic hopes, we may confidently look forward to be able to bask for the future in the sunshine of prosperity.

The change in the provisions of the Lick bequest is fresh in your recollection—a change most beneficial to us in every respect, which adds deeply to the debt of thankfulness we owe to him who has set so noble an example in the disposition of his wealth, and who has earned for all time the unbounded gratitude of lovers of science, not only in California, but throughout the whole civilized world. The property on Market Street deeded to us by Mr. Lick is now wholly in the hands of the Academy, the restrictions which existed in the former deed having been, as you are aware, entirely removed. Our annual income from this source will henceforth be in the neighborhood of $3,800, and it is to be believed that the rapid progress which San Francisco may be expected to make in the value of her real estate, will, in a few years, considerably enhance that sum. The number of members added to our list during 1875 has been twenty-seven, of whom two were life members. Some few have resigned, and we have lost four by death, viz.: Horatio Stone, B. P. Avery, W. C. Ralston, and B. F. Sherwood. Our total number of members is now nearly five hundred, seventy-eight of whom are Life Members, so that our monthly dues, should, if faithfully paid, bring us in about $5,500 per annum, making our total income a little over $9,000. It is a matter of regret, however, that many of our members are sadly in arrears, and the Council for the past year recently sent out notices to the whole of those who were deficient, stating that decided action will be taken in each case before the close of the year. It was, however, afterwards thought best to give these gentlemen an opportunity to pay their dues on the day of the annual election; but I

trust that the Council chosen to-day will follow up the intention of their predecessors, and at once drop the names of drones from the roll of membership. It would, I think, be advisable that a certificate of membership should be prepared and engraved for the Academy, to be presented to each member on his reception, and, that hereafter, the names of those who are discarded from our list in consequence of the non-payment of dues should be advertised in our proceedings at the end of the year; so that no one may be allowed to sail under false colors, and reap the benefits of the labors of those who are active and honorable members of the Society.

The Report of your Treasurer, which will be given to you in detail, shows a balance in hand of $1,593—and this, after paying for the printing of our publication of 1874, and the heavy expenses of altering this hall and supplying cases for our books and specimens. On the whole, therefore, our condition substantially is a satisfactory one; but I am able to speak in much higher terms of the scientific progress of the Academy, and the amount of work which has been accomplished. Our able director, Dr. Kellogg, has been absent for a part of the year, having been selected by the Government to make a collection of the woods of California for exhibition at the coming Centennial, which work he has most successfully performed. During his absence his place has been ably filled by Mr. W. G. W. Harford, who merits our warmest thanks for the interest he has always displayed in the Academy, and for the amount of industry he has brought to bear upon the duties of his position. We may congratulate ourselves upon his election for this year to the post of Director of the Museum.

Through the untiring energy of Mr. W. N. Lockington, nearly the whole of our Fishes, Crustacea, and Radiata, have been cleaned, identified and classified--a task which, apart from the scientific knowledge necessary for its performance, was one of very considerable labor, and a great tax on our fellow-member's time. Our collection of minerals, which now assumes considerable proportions, has been arranged and labeled by Mr. C. D. Gibbes, who has, during the past year, passed nearly the whole of his leisure time within the walls of this building. Our osteological collection, and especially our valuable series of crania, which for want of other room, are stored for the present in the basement, have been carefully cleaned, preserved and labeled, by

Dr. Stout, while our Birds have had the advantage of the supervision of Mr. F. Gruber, who promises, when cases can be found for them, to complete our series of California species and to make a MSS. catalogue of our collection, which may be published in our Transactions. To all these gentlemen whose labor has been cheerfully given, without stint and without thought of reward, the deepest gratitude of the Academy is due, and I am sure I have the authority of the members to convey thus publicly to them the expression of our truest and most hearty thanks. The donations to our collections have been both numerous and valuable—so numerous as to render it impossible for me to mention the names of all to whom we are indebted, though I cannot refrain from calling special attention to the many specimens of minerals received from various donors, including a fine set of New Zealand species, from Mr. McDevitt. Professor Eismark, of Christiana, Norway, has also enriched us by a present of European birds, Radiates and Crustacea; a fine collection of California woods has been presented by Mr. J. H. Clarke, of Mendocino; and from Dr. Burleigh we have received a valuable series of Alaskan Seals, both young and adult, in skin and in skeleton. Our corresponding member, Capt. J. H. Mortimer, has favored us with a beautiful set of pelagic Mollusca and Crustacea, including a specimen of the Portuguese Man-of-War, (Physalia Pelagica), most beautifully prepared, an object which, from its extreme delicacy, is rarely preserved, and therefore exceedingly scarce in museums. We have also received from various donors, large additions to our Shells, Radiates and Crustacea, all gifts having been duly and thankfully acknowledged. I trust that the importance of adding to our collection will not be lost sight of by members, and that all objects of interest which may come into their hands may be furnished to us for identification and preservation. As the whole of our treasures are gradually brought from the hiding places to which they have been too long consigned, we become more conscious of their extent and value, and the classification of the specimens which is now being proceeded with as rapidly as possible, will enable us to furnish information to those seeking it, and at the same time better display the desired genera and species of each department. It becomes, of course, a natural consequence that we should acquire duplicates of many

species, even after retaining full series in different stages of growth for the Academy's collection. To dispose of these to advantage is an object of paramount importance, and one to which the attention of the Council should be particularly directed. We especially need, to assist our already excellent collection of Crustacea, species from the Atlantic States, Europe, Africa and Australia. From the latter country and from New Guinea, we have every reason to hope for valuable contributions, and as our own Pacific Coast species are eagerly sought for by naturalists throughout the world, we may confidently expect that by a proper use of our duplicates, our number of species will, before the close of the present year, be certainly doubled. The same remark will apply in a greater or less degree to the other departments of Natural History, and I therefore urge upon all our friends, not to discard specimens because they may be thought to be common, as every one in good condition, whether existing in our series or not, is of value elsewhere, if not to us, and may be regarded as a gift of a new species to the Academy. For the proper display of our collections, however, more cases are immediately necessary, and as one of the matters most important to our interests during the present year, I urge upon the Trustees, as far as the funds at their disposal will allow, to take the subject of the display of all the materials in our possession into their serious consideration. A few hundred dollars judiciously spent now will give us case-room for some years to come, and the exhibition of our collections to the public, while it will not only assist scientific men in their investigations, will at the same time add an increased interest to our proceedings and draw from all quarters valuable contributions to our stores.

Our Library, under the able guardianship of Mr. W. J. Fisher, has considerably increased, and will shortly be rendered more accessible by a careful catalogue of every book and pamphlet upon our shelves, now being prepared by our Librarian, and intended to be subdivided into the different branches of study. We have received many important presents during the year, and I feel called upon to make special mention of the gift by our friend General D. D. Colton, of the most valuable series of Entomological works, including those of Hubner, Cramer, Drury and Stoll, all of which are profusely illustrated, and are of incalculable interest to students in that branch of science. To him,

as well as to all who have assisted us, our hearty thanks are most cheerfully offered.

The various papers which have been presented to the Academy have been of more than common interest, and will add very much to the value of our printed records. Among them I may be excused from mentioning two by our President, on the "Abrasion of the Coast of Japan," and "Probable cause of the low temperature at great depths of the Ocean." Mr. C. W. Brooks has given us precious information in his essays upon "Japanese works in American waters," and the "Commerce of Prehistoric races," while upon more special topics, we have had interesting papers from Dr. Kellogg, on the "Species of Eucalyptus," and on "Loco poison;" from Dr. Jos. Le Conte, on the "Ancient Glaciers of the Sierras;" from Mr. Amos Bowman, on the "Coal deposits of California;" from Dr. Cooper, on the "Land shells of the Coast;" from Mr. Lockington, on "Various species of Crustacea;" and from Drs. Blake and Behr, "Observations on the Phylloxera." Other matters have also been brought to your attention, to which it is hardly necessary for me to allude, as they will soon be before you in a published form, rendering the next volume of our Proceedings, in point of interest, nothing behind its predecessors.

The "Botany of California," the result of the labors of the Geological survey, will soon, through the public spirit of a few generous men, be given to the world, and it would be unbecoming in me if I did not here publicly express to Messrs. Leland Stanford, Lloyd Tevis, J. C. Flood, R. B. Woodward, Henry Pierce, D. O. Mills, Jno. O. Earl, Wm. Norris, and C. McLaughlin, the debt which all lovers of science owe to them for their noble munificence. Nor should our obligations to the scientific men who have had charge of the enterprise, and to whose knowledge of the subject we are so much indebted, be ever forgotten. Professors Asa Gray, J. D. Whitney, Watson and Brewer, have each and all devoted much time and labor to the work, and will always be entitled to the gratitude, not only of the members of this Academy, but of the future generations of scientists who may investigate the beautiful study of which they are such distinguished teachers. To Professor Gilman, also, whose absence is his gain, but our loss, we must render our thanks for the en-

* To Judge S. C. Hastings the gratitude of the Academy is also due, as it was owing to his exertions that public attention was first called to the necessity for this publication.

terprise and ability which he displayed in advancing the publication of these much needed and deeply interesting volumes.

And here allow me to say, that it may be confidently hoped that the present session of the Legislature will take a generous and extended view of the scientific requirements of our age, and see fit to revive the Geological Survey, thus completing its previous work and bringing its former labors into active usefulness. I know that this question is viewed by different minds under different aspects, and that there are many well-meaning people in the State who will regard such a movement with disfavor. This arises partly in consequence of the want of practical value of the achievements of the survey so far as it has gone, and partly from the utter inability of some minds to appreciate the use of scientific work altogether. With the latter class it is useless to argue. Time and results alone can effect a change in them. But the former may candidly be allowed to have some just cause of complaint, the economic wealth of our State not having been, in the comprehensive views of the chief of the Survey, yet reached in the plan he had laid down; but in the future, if the government of the State should see fit to grant a sum for the continuance of the Survey, it may be entirely within its province to say for what particular ends that sum is granted. If money be given for a special purpose, it is only fair that the giver should have something to say about the carrying out of the work; and if it should be deemed that a volume on the economic geology of the State, or on the insects injurious to agriculture, would be, as suggested by the press, of more immediate and personal benefit than one on paleontology, I fail to see the unreasonableness of the demand that these subjects should at any rate be first perfected and given to the people. The rest of the work would most assuredly follow in good time, and, year by year, it is hoped that our legislators will feel more interest in the pursuits and needs of scientific culture, and that the grandeur of their schemes lies not in looking to the immediate time, but stretching in its operation far out into the future, it expands into its fullest power and conveys its perfect influence to the generations yet to come. It is, I believe, intended that the matter of the Survey will be brought on its merits before the present Legislature, and I only thus briefly allude to it here to place on record the opinion of this Academy, as the representative of the

scientific energy of this coast, and its earnest desire to see so valuable a work brought to fruition—a work which, in California more than in any other State in the Union, seems marked out as the most important educational need of the people.

It appears to me, with reference to a plan for our future work, that the course adopted by the natural history societies in the Atlantic States and Europe, may with advantage be followed here. This is the sectionizing our labors, so as to bring more determined and persistent endeavors to each individual subject, and by concentrating our energies on certain given points, be enabled to accomplish more than we can ever do while our labors are so diffused. Thus we might have a geological section, a botanical section, an entomological section, and so on, the object of each of which should be earnest and energetic work in its particular department of study, and the formation of special collections belonging to each branch. No qualifications should be required for membership in these offshoots of the general body, beyond the fact that work will be expected from all, it being of course understood that the workers in all cases shall be members of the Academy. There is abundant strength in organization, and I should suggest that a chairman and secretary should be chosen out of the members of each section, that a faithful record of all proceedings, no matter how trifling they may appear, should be kept; that the members should meet at least once a week, and that all original papers should be then first submitted, and if deemed worthy of acceptance, should be read at the fortnightly meetings, and then find a place in our proceedings. We should thus, if such a course were persistently indulged, secure an interest for the general meetings which they now rarely possess, and should make our labors of more advantage to students than they can possibly now be. There is nothing in the Constitution to prevent immediate action on this subject on the part of the members, and I think the suggestion will be found to be well worthy the attention of the Academy. It may be deemed necessary, among the several branches, to have a small weekly subscription, if only to the amount of ten cents per week, for the purchase of periodicals, apparatus, etc., without encroaching upon the general fund; but of this I do not speak authorita-

tively, as many details may yet have to be arranged, and experience will be the best teacher as to our wants.

It is agreeable to observe a change in the manner which certain journals of the city have assumed toward the Academy in their reports of its meetings. Some time since it was too much the custom to sneer at our deliberations, and attempt by some ill-judged witticisms to underrate their importance; but of late careful and respectful attention has been given to what passes here, and a more considerate tone has been taken by those representatives of the press who were once wont to assail us with unfair criticism. Science, no less than literature, aims at the elevation and refinement of mankind, and her struggles for the progress of the race should be encouraged by all who value the welfare of their fellows. And if my feeble words may reach the moneyed men of California, I would say to them that a field of benevolence is open to them, on which some of their surplus riches may be spent, which is fraught with incalculable advantages to the rising generation. I mean a thorough and scientific exploration of this most interesting country, and the collection of specimens in all branches of natural history, so that a museum of the Pacific Coast worthy of the name may find its home in San Francisco, and the riches we possess at our very doors may be brought together for preservation and for after use, instead of being now transmitted to Europe and across the continent to enrich the collections of older and wiser communities than ourselves. It is true that much has already been done by private investigation, but after all the bulk of the work remains undone. Naturalists as a class are invariably poor, and need help from their more fortunate brethren. In the single matter of Indian relics alone, the field is almost infinite, the late expedition to Southern California, under Lieutenant Wheeler, taking from the neighborhood of Santa Barbara over thirteen tons weight of these interesting memorials for exhibition at the Centennial. These will find their way into some of the museums of the Atlantic States, and be regarded as among the most valuable of their deposits, while California tamely allows herself to be deprived of objects which should surely be under her care alone. In every branch of natural history, too, the same remarks will apply. Our species have in many instances, for the want of literature or a full series of specimens, been sent elsewhere to be described, and the original types

are consequently lost to us; but with a band of workers under the sectionizing system which I have previously suggested, this may be avoided, provided the material for comparison and complete study of individual groups be placed within our reach. Hand-books of the various families in each branch of natural history could then be cheaply published, and throughout the State an impetus would be given to the study of nature which no other means can furnish. A few thousand dollars thus expended would place the givers high upon the pinnacle of fame, and hand their names down to those who shall come after us as worthy of respect and their deeds as worthy of imitation. In a community like our own, where riches seem to fall unsought into the laps of their possessors, it is well to inculcate the thought that not alone upon the battle ground of wealth can the victory of life be won; that there are triumphs purer and more abiding than worldly treasure, more powerful in their influence for humanity, than the grandest display of personal aggrandizement, and more calculated to sink deeply into the character of the coming ages, than the amassing of riches, unprofitably distributed, can ever do. Individuals have done much good in aiding the *material* progress of our State. Can some few be found to assist her *intellectual* advancement, and to make bright the toilsome path of science with the beacons of their kindly succor?

HENRY EDWARDS,
First Vice-President.

David D. Colton, President of the Board of Trustees, presented his annual report, which was read by the Secretary, as follows:

To the Trustees and Members of the California Academy of Sciences:

This being the close of the first fiscal year under the new organization of the Academy, it would seem proper for me to give a brief statement of the condition of the "temporalities" of the Academy, which by our new Constitution comes exclusively under the control of the Board of Trustees.

The Treasurer's report shows that at the commencement of the present year we had on hand $2,900, and that the present condition of the treasury shows $1,593.73 now on hand.

All matters in the way of expenditures have been carefully scrutinized, and the greatest economy maintained in all matters pertaining to the expenses of the Society. It will be observed that we have considerably reduced during the year the amount of cash on hand. Some purchases and expenditures connected with the alteration of the building in which we meet seemed unavoidable, and we feel certain that the improvements made as the result of this expenditure will be justified by the members of the Academy.

It is with a degree of great satisfaction that we are able to report to the Academy that we have taken possession of the munificent donation of land on Market street, in this city, from Mr. James Lick, he having given us the title, absolute in fee, to the same, which had heretofore been conditionally deeded by him with such restrictions as left grave doubts in our minds as to whether the gift would ever be of any practical utility to the Academy. The amount of rents per annum derived from the property at the time we received the same, were about $2,300. These have been increased nearly 100 per cent., and we feel justified in the expectation that this property, for the coming year, will produce us gross about $5,000; and from the most reliable information, taken in connection with the provisions in our favor in the last deed of trust as executed by Mr. Lick, we are warranted in the belief that this princely gift will enable the Academy to erect on the ground, within a few years, one of the most magnificent temples of science on the face of the globe.

It has been a matter of regret that we had not a more extensive fund to draw from for purposes of publication, and that so important a branch has been unavoidably curtailed for want of sufficient funds to justify publications which we have been compelled to omit. As the report of the Treasurer shows, a large number of members have defaulted in their dues. Had those payments been made, it would have materially assisted our publication fund.

It is but justice to Mr. H. M. Newhall to say, that his liberal donation during the past year of $1,200, to be applied on the rent, has been of great assistance to us, and we feel he deserves the thanks and gratitude of the entire Academy.

To the Trustees I return my sincere thanks for their prompt attendance on all the regular and many special meetings during

the year, and for the deep interest manifested by all of them in the prosperity of the Academy, and for their jealous care and watchfulness for its best interests.

It is but justice to the Secretary, Mr. C. G. Yale, to say that for his promptness at all our meetings we are very thankful.

I remain, very respectfully, yours,

DAVID D. COLTON,
President Board of Trustees.

The Recording Secretary, Charles G. Yale, read the following annual report:

To the President and Members of the Academy:

As Recording Secretary of the Academy during the year 1875, I have simply to report what relates to new members, papers presented, and attendance at meetings.

The total attendance of members at meetings during the year has been 842, an average of 31 members at each meeting.

Twenty-seven new members have been elected, four have died, and three have resigned. The total resident membership is now 301, and the life members number 78. A list of those who became members in 1875 is appended, as well as a list of the forty-one papers read during the year, with names of authors, etc.

CHARLES G. YALE,
Recording Secretary.

Wm. J. Fisher, Librarian, presented his annual report, giving the condition of the library, as follows:

REPORT OF LIBRARIAN.

Mr. President and Members of the Academy:

During the past year our Library has received considerable additions, as well by our usual regular exchanges, as also by donations from individual members of our Society.

Especially are we indebted to our former fellow member, Professor Gilman, for a large collection of works on History and Geography, and to General D. D. Colton, for a number of very rare and costly works on Entomology.

During the latter part of the year, the Library has been removed from its former position in the gallery to its present place, and, by order of the Trustees, a number of new cases have been constructed for the accommodation of the rapidly increasing material.

I have completed the Catalogue of the works in the Library pertaining to the different scientific departments, and am now engaged in cataloguing the Proceedings received by us from sister societies.

In pursuing this work, I find a vast number of duplicates, and of works not strictly of a scientific character. A great many of these books are valuable, and I would respectfully suggest that authority be given to dispose of them, either by sale or exchange.

I also beg to call the attention of the Academy to the fact, that a considerable number of very valuable works require binding, and that by neglecting this important duty heretofore, a great many of these works have become defective.

I enclose a list of such literature as, in my opinion, should receive this attention at once, and hope that a sufficient sum will be appropriated for this purpose without delay.

A great mass of new material received by the Academy is left undescribed, for want of the proper literature, compelling us to leave to other Societies, better supplied in this respect, the honor of describing and publishing in their Proceedings, articles which otherwise would have found a space in our own Proceedings.

The following standard works, carefully selected, ought to be added to the Library as soon as possible, viz:

Ichthyology and Herpetology.

Gunther's Catalogue of Fishes; Catalogue of Apodal Fishes; Catalogue of Shield Reptiles.

Zoology.

Catalogues of Mammalia.

Crustacea.

Milne Edward's Histoire Nationelle des Crustacea; Dana's Crustacea; Bate and Westwood's Brit. Sessile-eyed Crustacea; Bell's Brit. Stalk-eyed Crustacea.

Radiates.

Forbes' Brit. Star Fishes; Johnson's Brit. Zoöphytes.

Protozoans.

Bowerbank's Brit. Sponges.

Osteology.

Huxley's Elementary Atlas of Comparative Osteology.

Ornithology.

Baird, Brewer and Ridgeway's History of N. A. Birds.

Botany.

De Candolles' Prodromus.

Our Ethnological department is at present very meagre, comprising only a few pamphlets and proceedings of foreign Ethnological Societies. I would suggest that the work lately issued by our fellow townsman, Mr. H. H. Bancroft, on "The Native Races of the Pacific States," which has been very highly commended, as well by scientific men here as abroad, be secured for this department.

Very respectfully,

WM. J. FISHER,
Librarian.

The Director of the Museum, Dr. Albert Kellogg, reported on matters under his charge, as follows:

REPORT OF DIRECTOR OF THE MUSEUM.

As Director of the Museum of the California Academy of Sciences, it is but just to say, at the outset, that the improved order of arrangement witnessed by you, was inaugurated, supervised, and mainly executed, with distinguished zeal and ability, in my absence, by Mr. Harford, my improved substitute and Director *pro tem.*—of course, by and with the consent and coöperative aid of others. For my part, I candidly confess the idea of temporary occupancy had, to some extent, weakened my enterprise in the direction of pressing necessities. With this new field of space utilized, I trust we may be able to furnish it with the needed cases. If we can only provide the books and means to identify and care for collections, the men, as curators and members of all work, will see that there can be no cause of complaint at the close of 1876.

I am aware that we have little means to expend; but if our urgent wants were known, it might lead to the ways and means.

In the department of Minerals, the past year, we have received 340 donations.

Mr. Chas. D. Gibbes, whose singleness of purpose, and hearty sympathy has ever been steady to the Academy's interests, failing to arouse a proper zeal in behalf of this department, at length determined to see some system inaugurated, of more pratical utility to the miner and general enquirer. While the strictly scientific arrangement of the Curator was not in any way disturbed, he has bestowed great labor and ability in sectionizing the department, according to Countries or Nations, States and Counties, thus facilitating special reference. Now, a person desirous of visiting a certain section, can seek and readily find sectional information; or, if more time is at his command, and not satisfied with this localized cabinet, he may search the general cabinet. This special system is somewhat similar to an immense promiscuous volume, well indexed, and to some extent topographically sectionized, while the other affords no such bird's eye facilities; but to execute the plan well, needs much room. With the coöperative contribution of Mining companies, only abating the merest iota of the monster specimens so zealously sent abroad, in less than a year this system could be adequately established.

We have many wealthy members offering us subscriptions for timber, bricks, and mortar, to the extent of thousands of dollars. Now, seeing this is no longer needed, why not pay a trifle—of course, selecting their own way of doing it—to such parties as they may choose to invite to their expedition, as canvassers and collectors, etc., and let them visit the mines, etc., and so be accredited for their collections, *e. g.*

This age is already deciding that the best monuments are those most useful, and such will be the wise decision of posterity.

It is high time to be preparing and arranging our cabinets for the new

building. Many of these specimens have been so long packed away, as to render the tags illegible.

Tons upon tons of minerals, fossils, and prehistoric relics, are journeying towards the rising sun, obedient to Eastern enterprise. Nor need we wish there were less, but that many might also find a home here, where scientific data are also prized; though the sacred proverb reminds us that the worthy prophets are not without honor, save in their *own* country.

Donations of *Crustaceans* during the year, are 57; Radiates, 21; Fishes, 22; Reptiles, 6; *Vermes*, 2; *Arachnidæ*, 3; *Myriapoda*, 23. Only a very remote idea of the work done, can be obtained from the Director's Catalogue of Contributions. Mr. Lockington has labored with commendable zeal, as the details of his department manifestly show. With the requisite books of reference, tenfold more may be accomplished with a little of the toil called forth last season. We trust all such indefatigable workers will be afforded needful aid.

In the department of Birds, Mr. Gruber informs me, about 150 have been donated to the Academy. About one-half of the collection have been classified and catalogued, but, owing to the confusion of recent changes in the names, etc., it was deemed advisable to await American authorities, so much needed. These have been added without any cost to the Academy, which is indeed a large contribution.

In Botany, 120 donations. The Curator of this department has left everything in *statu quo*. Two paid curators employed a year, could not identify, classify, and poison the Herbarium, nor can we hope for any one without ample means of support, to undertake it; yet more, at least, than last season, ought to be expected.

The Mammals, 5 were kindly cared for by Mr. Gruber.

The donations of Shells amount to 69; Insects, 1; and Miscellaneous, 25.

As matters of special notice, it is due to say, that Dr. Burleigh has donated the skeleton of a seal, which, when able to set up properly, will add much to the scientific and general interest of the Academy.

Dr. A. B. Stout has also expended much labor and care in neatly cleaning and preparing a rare and varied collection of anatomical specimens for the Museum, for which the Academy are under many obligations.

Rev. E. R. Greene has also furnished us with a fine collection of well identified plants, from Colorado and the interior, which have not been distributed, and therefore do not appear in the enumerated catalogue.

It should be stated that other large and valuable collections have been received *en masse*, and not being opened, have simply passed on the list as one presentation. It would be better, hereafter, to open, enumerate, and if need be, repack such ample contributions, in order that the record may be historically more useful, and more full and just to our patrons. This was intended in all cases, but many who were competent to label and distribute them properly, having given us their promise to do so, from press of private business or other causes, failed to aid us. We trust that neither our successor, nor future contributors, may ever have any such just cause of complaint.

Respectfully submitted,

A. KELLOGG,

Director of the Museum of the California Academy of Sciences.

The Board of Trustees presented, through the Secretary, a statement in detail of the receipts and disbursements of the year, presenting vouchers of same, with monthly abstracts, checks and accompanying papers. The annual report was as follows:

ANNUAL STATEMENT OF THE BOARD OF TRUSTEES.

Amount in Bank of California, February 20th, 1875, at time Board of Trustees for 1875 took charge of disbursements		$2,900 00
Sundry deposits to date		1,769 78
Retransferred from London and S. F. Bank to Bank of California		1,293 00
Expenditures in Museum for cases, shelves, repairs, alcohol, bottles, etc	$ 558 55	
Salaries and Commissions to Curator of Museum, Secretary of Board of Trustees, and Treasurer	1,021 15	
Rent	1,650 00	
Expense account, (including fuel, cleaning, etc.)	142 40	
Advertising meetings	32 80	
Printing, (including Proceedings, blanks, checks, vouchers and abstracts, receipts, postal cards, labels and tags for Museum, engraving for Proceedings, etc.)	679 89	
Stationery and Binding	98 04	
Freight, C. P. R. R.	6 70	
Water	6 00	
Repairs to Building, (Gas Fixtures, Mending Roof, etc.)	132 92	
Periodicals for Library	40 60	
Total Expenditures, 1875	4,369 05	
Balance in Bank, December 31, 1875	1,593 73	
	$5,962 78	$5,962 78

The Trustees desire to add to this annual statement the fact, that of the above expenditures, the sum of $819.29 was for indebtedness incurred by their predecessors in office. The details of these expenditures are as follows:

C. E. Boman, fixing shelves in Museum	$ 129 00
Bacon & Co., printing Proceedings of 1874	265 55
Bacon & Co., printing Proceedings of 1874, (minus $12 for this year's work)	261 84
Advertising	21 75
Springer, (Lumber)	11 55
Contingencies of Curator in December, 1874	35 50
Curtain bought for Museum	3 50

Periodicals furnished	$40 60
Dewey & Co., Engravings for Proceedings 1874	50 00
	$819 29
Total this year	4,369 05
Deduct last year's Bills (1874)	819 29
Leaves as Disbursements by present Board of Trustees	$3,549 76

A communication was received from the Board of Trustees, suggesting that a vote of thanks be given to certain members of the Academy for gratuitous work performed during the year. On motion, in accordance with the suggestion, a vote of thanks was passed to the following gentlemen: W. N. Lockington, W. G. W. Harford, C. D. Gibbes, W. J. Fisher and A. B. Stout.

The report of the Treasurer was read by the President, giving the amount of collections made during the year.

On motion, the reports of all the officers were accepted and ordered printed in the proceedings.

The report of judges and inspectors of election was received and accepted. A vote of thanks was passed to these gentlemen for the faithful performance of their duties.

Their report showed the following as the result of the annual election:

PRESIDENT,

GEORGE DAVIDSON.

FIRST VICE-PRESIDENT,

HENRY EDWARDS.

SECOND VICE-PRESIDENT,

HENRY C. HYDE.

CORRESPONDING SECRETARY,

THEODORE A. BLAKE.

RECORDING SECRETARY,

CHARLES G. YALE.

TREASURER,

EDWARD F. HALL, Jr.

LIBRARIAN,

W. J. FISHER.

DIRECTOR OF MUSEUM,

W. G. W. HARFORD.

TRUSTEES,

D. D. COLTON,
JOHN F. MILLER,
THOS. P. MADDEN,
R. E. C. STEARNS,
WM. ASHBURNER,
GEORGE E. GRAY,
RALPH C. HARRISON.

On motion of Mr. Ashburner, the Vice-President was authorized to appoint a Committee to take into consideration the matter of sectionizing the Academy, to report at the next meeting.

Regular Meeting, January 17, 1876.

First Vice-President in the Chair.

Thirty members present.

Z. W. Greene and Dr. Murphy were elected resident members.

Donations to the Museum: From Henry Edwards specimens of *Sebastes nebulosus*, *Psettichthys melanostchthys*, *Sebastodes flavidus*, *Pleuronichthys marmoratus*, *Embiotica lineata*, *Metrogaster aggregatus*, *Bryttus*, sp? *Octopus punctatus*, *Lithogphagus*, sp? Also botanical specimens as follows: *Abies Pattoniana*, *Pinus flexilis*, *Pinus tuberculata*, *Pinus monticola*, *Librocedrus decurrens*. From the same donor was received a specimen of *Actinemys marmoratus*. Mr. W. G. W. Harford presented specimens of fish as follows: *Chiropsis nebulosus*, *Sebastes ruber* and an Alcyonoid polyp. Dr. R. K. Nuttall presented specimen of *Ostracion*, and Mr. W. G. Blunt five specimens of Eutænia. Mr. W. N. Lockington presented a specimen of *Caprella Californica*. Minerals were received as follows: From T. H. Folingsby six vials containing a number of precious garnets; one vial red and green garnets; one vial with ten specimens, supposed to contain black diamonds; one vial with quartz crystals; and one vial of green and white quartz—all from Choco, New Granada. F. A. Walley presented a specimen of Calute from near Martinez. Dr. Stout presented specimen of building stone from near Petaluma. From G. W. Sanders five specimens petrified wood and charcoal. From C. D. Gibbes fibrous asbestos and mica from Ruby Valley, Nev. From G. B. Merriam granite from Young's Temple, Salt Lake. From T. H. Sacket three specimens chalcedomy from Temescal, Alameda County. From J. H. Mortimer bog turf, Galway, Ireland. From Henry Edwards silver ore, Panamint, Inyo Co., Cal.

C. B. Turrill read a paper by Chas. Wolcott Brooks recom-

mending a course of popular scientific lectures before the Academy. Mr. Turril read a supplementary paper on the same subject.

Henry Edwards read a paper on Pacific Coast *Lepidoptera*, No. 16.

Pacific Coast Lepidoptera.—No. 16. Notes on the Transformations of some Species of Lepidoptera, not hitherto recorded.

BY HENRY EDWARDS.

With the desire to add, little by little, to the knowledge of our species of Lepidoptera, I think it of importance to present to entomologists every observation which I am enabled to make with reference to their transformations, and though in some instances I am only able to give notes of the egg, in others, of the early larval stage, and still in others, of the more mature conditions, I regard these as of extreme value in assisting to perfect our knowledge of the life-history of each species, and as an aid to other workers who may have opportunities different from my own. As the paleontologist can, from the fragmentary portions of extinct animals, sometimes obtained from regions remote from each other, build up a complete description of the species under his consideration, so do I hope that these incomplete studies may aid the future student of the habits and history of our yet slightly known insects, and thus become the foundation upon which a better superstructure may be raised. The whole field of research in this department is yet untraversed, and will amply repay the investigator in this most interesting branch of natural science, and as before, I entreat those into whose hands examples of the early stages of any of our insects may fall, to omit no opportunity of making known to myself, or others engaged in entomological pursuits, the results of their observations.

Since the publication of my last paper on the transformations of our Lepidoptera (No. 14), the following species have come under my notice:

Family PAPILIONIDÆ.

Papilio Philenor. Fab.

Chrysalis. The usual color of this stage of Philenor has been a grayish stone color, mottled with violet and yellow; but from two caterpillars found feeding, in June last, on Aristolochia at Saucelito, I have obtained chrysalides so different in color, as almost to suggest another species. They are pale, but vivid, yellowish green, of a very lively tint over the whole surface, which is covered with minute blackish reticulations. The edges of the wing cases, abdominal tubercles, apex of the mesonotal process and edges of the antennæ cases rich purplish brown. Out of the same brood of thirteen caterpillars, eleven assumed the normal coloring. They all went into the chrysalis state from June 28th to July 17th.

Fam. NYMPHALIDÆ.

Limenitis eulalia. *Bdv.*=*Californica.* *Butler.*

Larva. General color, pale greenish or fawn color, becoming entirely of the latter tint when about to undergo its change. Body covered with small whitish spines. Head rather large, edged on its margins with a row of slightly branched whitish spines, each tipped with black; 2d segment constricted, without spines; 3d, 4th, 6th, 11th and 12th, each with a pair of long and branched spines, tipped with black; 7th, 8th, 9th and 10th, with shorter pair of similar spines. Below the spiracles, which are fawn color, is a darker line. Feet and legs concolorous.

Length, 1.20 inches.

Food plant, *Quercus Douglassii*, *Quercus Sonomensis.*

Chrysalis. The specimens from which my first description was taken (Proc. Cal. Acad. Sc., Vol. V, Part II) differed from the present one, in that the latter had a most beautiful pale golden blotch over the whole region of the wing cases. This chrysalis was semi-transparent, ash gray or drab, and was attached to the under side of the oak leaf by strong silken threads; the whole of the surface of the leaf being covered by the web.

Changed to chrysalis, August 20th. Imago, September 3d.

Fam. LYCÆNIDÆ.

Lycæna antægon. *Bdv.*

Larva. Head small; dark brown. Body dirty yellow, covered with very short downy hairs; a few black spots irregularly scattered, and a narrow greenish dorsal stripe. Spiracles, small; dark brown.

Length, 0.50 inch.

I am indebted to Dr. Behr for an opportunity of observing the larva; specimens having been found by Mr. Graham, one of Dr. Behr's students, feeding in the pods of *Astragulus.*

Fam. SPHINGIDÆ.

Deilephila daucus. *Cram.*=*Lineata.* *Fab.*

Larva. Mature. General color pale apple green. Head and 2d segment with more olivaceous tint, thickly dotted with greenish white warty spots. Mouth parts, dull yellowish. There is a bright green dorsal line, varying much in width in different individuals; sometimes merely a line, at others occupying nearly the whole dorsal surface. This is uneven at its edges, which merge into black subdorsal lines, enclosing a bright yellow streak. Both the black and yellow lines are widest anteriorly, the latter in some specimens becoming an orange patch. Posteriorly on the black lines are some small yellow dots. Caudal horn dull yellow, rough, black at the tip. Anal segment similar to the head. Spiracles orange, surrounded by a black patch, in which are some small yellow dots. Above the feet, which with the legs, are dull yellow, are some waved black lines, occasionally obsolete.

Variety. After the fourth moult, the caterpillar sometimes, but only rarely,

assumes a very strange appearance. It becomes quite black, every trace of green being lost. The head and anal segment are then bright chestnut brown, with paler dots; while the feet and legs are dark orange. There is a faint trace of a yellow subdorsal line, and the spiracles are dark orange, with a faint lateral line below them. Between their extremes are many varieties of color.

Chrysalis. Very long and cylindrical; light chestnut brown, Tongue case wanting. Head and wing cases entirely without irrorations. Abdominal segments darker posteriorly, very rough, and dotted with darker points. Spiracles large, ovate, dark brown.

Length, 2.10 inches Width, 0.40 inch.

The caterpillar feeds on *Rumex*, *Epilobium*, *Pelargonium* and *Fuschia*. To the last named garden plants, it is extremely destructive: It is full-grown in June; changes to chrysalis from that month to the end of July, burying itself rather deeply in the ground. The perfect insect appears from August to October. It is quite common in gardens throughout this State.

Smerinthus opthalmicus. Bdv.

Egg. Deposited separately on the food plant. Ovate, cream yellow, very smooth and shining, surrounded by a ring of lake red color. Before the exclusion of the larva, the eggs change to a pale, and afterwards to a dull greenish blue, the reddish ring being lost. Deposited, July 20th, on willows.

Young Larva. Emerged July 28th. Very pale yellowish green. Head very large, almost monstrous, and of a darker shade. Caudal horn pinkish brown, darkest at the tip. After the second moult the oblique yellow stripes make their appearance, and there is then little change save in size, until the

Mature Larva. General color pale apple green. Head rather large, truncate in front, pyramidal, the two sides of the angle broadly and distinctly edged with bright yellow, and enclosing a corrugated space, darker green than the rest of the body. Mouth parts, and feet reddish brown. The whole of the segments are marked with whitish tubercular dots. Along the sides is a narrow stripe of pale yellow, and from the 4th, 5th, 6th, 7th, 8th, 9th and 10th segments proceed some oblique yellow stripes, the 10th being the broadest, and continued to the junction of the caudal horn, which is dull sky blue, the extremity black. The anal segment is also edged with yellow. Spiracles white, edged with reddish brown. Abdominal legs, dull apple green.

Apparently double brooded, as I have taken fresh specimens of the perfect insect in February and March, while the specimens from which the above description is drawn, went into chrysalis in July, the moth emerging in the middle of September.

Fam. BOMBYCIDÆ.

Halesidota Edwardsii. Packard.

Egg. Laid in irregular clusters. Ovate, slightly flattened at the apex, and often forced out of its regular shape by a large mass being crowded into the fissure of the bark chosen as the place of deposition. Color, dull yellow, paler on the upper half, and there slightly transparent. There is no apparent sculpture, the whole surface being quite smooth and shining.

The young larvæ, which are quite black, with very long hairs, appeared on May 5th, the eggs having been deposited on April 24th. The mature form of the larvæ is described in Stretch's "Zygæindæ and Bombycidæ of North America," page 88.

Spilosoma vestalis. Packard.

Egg. Laid in compact masses upon the food plant. Color, cream white, surface slightly wrinkled, the wrinkles when viewed through a powerful lens appearing to be a series of punctures. Eggs deposited May 15; larvæ emerged May 21st.

Young Larva. On exclusion from the egg the larvæ are dirty greenish black, with the head large, and the hairs remarkably long. After second month, the body becomes whitish green, with the head slightly pitchy. The 2d, 3d, 4th, 6th, 7th, 8th, 9th and 10th segments have four small blackish tubercles, armed with whitish spines laterally, and blackish ones dorsally. The 5th and 11th segments have still larger black tubercles. The dorsal region is darker than the sides, which generally have a yellowish tint. Feet and legs, greenish white. After the third month, the whole of the lateral hairs become bright chestnut brown, almost deep orange; those of the dorsal region darker brown, and beyond the 4th segment anteriorly, and the 10th posteriorly, the hairs of the dorsal tubercles are black; the tubercles also become hidden by the hairs. Subsequent to the fourth moult, the whole of the dorsal hairs are largely and broadly black, and the lateral series bright chestnut brown. In this condition, the larva may be readily mistaken for that of *Spilosoma acrea.*

Mature larva. Body slate black, glossy. Dorsal bunches of spines, rich velvety black; those of the lateral region, bright chestnut brown; underside, ash color. The spines are all very glossy and rich in color.

Length, 1.75 inch.

Food plant, various sp. of *Lupinus.*

The larvæ were fully fed in the early part of July, being exceedingly voracious, though able to exist for four or five days without food, and suffering no apparent inconvenience. About the 10th of the month, they began to spin cocoons, mixing up with their webs the remains of leaves and stems of their food, the whole of eleven larvæ which I carried successfully to their last stage, changing almost on the same day to the condition of chrysalis. The perfect insect is usually met with in April, and in warm seasons as early as March.

Pseudohazis eglanterina. Bdv.

Egg. Ovate, stone color, agglutinated together, and arranged in a compact mass around the stem of the food plant, generally near the extremity of the branches. The eggs are attached by their smallest end, the larvæ escaping from the apex.

Mature Larva. Head black, shining, with a few short, brownish hairs. Body entirely dull black. Each segment is armed with six lateral spines, very finely branched, and two dorsal fascicles of spines, bright chestnut color, blackish in the centre. The branchlets of the spines are all bright

chestnut color. Underside, as well as the feet and abdominal legs, dull black.

Length, 2.00 inches.

Food plants, *Frangula Californica*, and various species of Rosa.

Hemileuca Nevadensis. Stretch.

Head shining, reddish brown. Body, pale citron yellow; 2d segment with reddish brown transverse streak, armed anteriorly with six black spines, having pale yellow branches; 3d, 4th, 5th and 6th segments, each with eight spines; 7th, 8th, 9th, 10th and 11th, have six spines each; 12th and 13th, only five, the middle one of the last being placed posteriorly to the other four. The whole of the lateral spines, as well as those of the 13th segment, are black, with pale yellow branches. Those of the dorsal pair of segments, three to eleven inclusive, are dull yellow, mottled with black, as is also the medium bunch of spines of the 12th segment, giving, when viewed without a lens, the appearance of a yellow dorsal line. There is a narrow central line of reddish brown, and each segment is also marked with transverse streaks of the same color, which, on the sides, become a broken but well defined band. Spiracles, orange, edged with reddish brown. Feet and legs also reddish brown, and segment tipped with the same color.

Length, 2.00 inches.

Food plant, Willows.

The above description is taken from one of several caterpillars, obtained in Fresno Co., Cal., by Dr. Eisen, and by him forwarded to Dr. H. Behr. In the description of the larvæ of *H. Maia Drury*, I find a notice of two reddish tubercles on each segment, which are entirely absent in the present species. In other respects they are much the same. *Maia* generally feed on oaks, while this was invariably found upon willows, and fed in confinement upon the weeping willow of the gardens.

Fam. NOCTUIDÆ.

Acronycta lepusculina. Grote.

Mature Larva. General color of body pale bluish green. Head a little paler. Mouth parts and prolegs deep black. Spiracles black, with whitish centre. The whole of the body is covered with very long silky white hairs, $\frac{3}{10}$ of an inch long, with some shorter black ones mingled, chiefly in the dorsal region. Abdominal legs bluish green.

Length, 1.10 inch.

Food plant, Poplars.

Changed to chrysalis July 23d; Imago, September 26th.

Drasteria erectho. Bdv.

Egg. Spherical, a little flattened at the poles; color, pale apple green, deeply striated, but with the striæ not reaching to the apex. Spaces between the striæ transversely rugged. Deposited separately on leaves of *Lupinus* and *Erodium*.

Fam. GEOMETRIDÆ.

Cidaria, 4-punctata. Packard.

Head and 2d segment, dull rose pink, the same color being continued broadly along the sides. In the lateral region are some small white dots. Dorsal region and underside, bright apple green, each segment tinged indistinctly with dull orange yellow. Feet and legs, dull rose pink.

Length, 1 inch.

Food plant, Fuschia; the stems of which plant are wonderfully mimicked in color by the caterpillar.

Chrysalis. **Light brown, paler at the junction of the segments, each of which bears a transverse row of minute concolorous hairs.**

Length, 0.60 inch.

Spins a very thin web on the underside of the leaf, which is slightly rolled at the edges.

Changed to chrysalis, June 25; Imago, August 4.

LIST OF SPECIES NOTICED IN THIS PAPER.

Papilio Philenor	Chrysalis.
Limenitis Californica	Larva and Chrysalis.
Lycæna antægon	Larva.
Deilephila daucus	Larva and Chrysalis.
Smerinthus opthalmicus	Egg and Carva.
Halesidota Edwardsii	Egg.
Spilosoma vestalis	Egg and stages of Larvæ.
Pseudohazis eglanterina	Egg and Larva.
Hemileuca Nevadensis	Larva.
Acronycta lepusculina	Larva.
Drasteria erectho	Egg.
Cidaria, 4-punctata	Larva and Chrysalis.

Dr. Henry Gibbons called attention to the frequency of earthquakes in different parts of the world during the present month.

The following propositions for membership were submitted:

W. H. Hall, J. P. Curtis, H. S. Craven, C. A. Stetefeldt, W. A. Skidmore, Howard Schuyler, Alfred Poett, James D. Hague, E. B. Dorsey, Hamilton Smith, Jr., Louis Janin, Charles Barton Hill, Joel F. Lightner.

On motion of Mr. Stearns, the Vice-President was authorized to appoint a committee of ten to confer with the Committee of the Art Association upon the subject of the obsequies of the late Benjamin Parke Avery.

The Committee appointed in the matter of sectionizing the

Academy, presented their report in the form of a preamble and resolutions, as follows:

To the California Academy of Sciences:

The Special Committee in the matter of Sectionizing the Academy, which was appointed at the last meeting, herewith present their Report, in the form of a Preamble and Resolutions, and respectfully request your favorable consideration.

WHEREAS, In many Scientific Societies, experience has proven that the objects for which such societies were founded and organized, namely, the advancement of Science and the diffusion of knowledge, have been promoted by the formation of sections for the pursuance of special studies and investigations, and as it is believed by many members that the formation of sections inside of the California Academy of Sciences will increase the usefulness of this Academy, and many of its members desire to form such sections, it is hereby

Resolved, That it is the sense of this Academy, that the objects for which it was founded will be advanced by the formation of sections, which may include such members as are pursuing special departments of scientific investigation and study, and as many members have expressed a desire to form sections in order to facilitate such investigations and studies, it is hereby provided that sections may be formed, and in the following manner, and under the restrictions herein contained.

Whenever not less than five members of the Academy shall unite to form a section, they shall have the right to do so, but shall first submit to the Council of the Academy, a written communication, signed by the members who propose to form such section, stating the department of science or the character of the investigation or study which it is intended the section shall pursue; but no section shall be considered as formed or be recognized by the Academy, until due notification thereof, which shall be made to the Academy by the President or the Recording Secretary, or in the absence of said officers, by some other member of the Council, at the first regular meeting of the Academy after or following the receipt of the communication from the members proposing to form such section.

And upon and after such notice at a regular meeting as above, such section shall be considered as established, and a written notice of the same shall be posted in a conspicuous place in the hall of the Academy, and the members of the latter shall have the right to attend the meetings of the section so formed. Persons not members of the Academy shall not be members of any section.

Sections formed as above, may make such by-laws as are deemed necessary, and the members thereof shall have the power to manage the affairs of the section to which they belong, and only the members of a section shall have the right to vote upon matters pertaining to the section to which they belong.

Provided, however, that no by-law or regulation made by any section shall conflict with the Constitution or By-Laws of the Academy.

If at any time it shall be found that the action of any section is detrimental

to the interests or objects of the Academy, or that any section through the apathy or dissensions of its members, shall cease to pursue or carry out the objects for which it was formed, or for any other good and sufficient cause, then the Academy may suspend or abolish such section by a two-thirds vote of the members present at any regular meeting, and any section so suspended or abolished shall not be continued or restored except upon the recommendation of the Council at a regular meeting of the Academy, and by a two-thirds vote of the members present.

Any and all property acquired by any section, shall be the property of the Academy, but may be segregated and kept apart from the general property of the Academy, for the special use of the members of the section to which it belongs, so long as such section may exist, but upon the dissolution or abolishment of any section, then the same shall be merged in the general property of the Academy.

A notice of the meeting of any section shall be posted in a conspicuous place in the Hall of the Academy, or announced at any regular meeting of the latter, but no meetings of any section shall be held during the hours or period of any meeting of the Academy, but at such other time as may be found convenient to the sections, and may be held in such rooms in the building of the Academy as may be available.

All of which is respectfully submitted,

ROBT. E. C. STEARNS,
A. KELLOGG,
WM. ASHBURNER,
HENRY EDWARDS,
Special Committee.

SAN FRANCISCO, January 7, 1876.

On motion of Mr. Scupham, the Report was adopted, and the Secretary instructed to spread the Preamble and Resolutions on the records, for future reference.

The Committee was continued, to aid in organizing the sections.

REGULAR MEETING, FEBRUARY 7th, 1876.

Second Vice-President in the Chair.

Twenty-one members present.

In the absence of the Secretary, W. J. Fisher was elected Secretary *pro tem.*

The following new members were elected:

C. L. Scudder, W. J. Graves, Samuel Purnell, Joseph Tilden, G. L. Lansing, Dr. R. K. Nuttall, Dr. J. T. Crook.

The following propositions for membership were submitted: S. Lubeck, life member; T. Bechtinger, resident member.

Donations to the Museum: Prof. Geo. Davidson presented the following: Rye from the Russian shores of the Baltic, plant and seed from Japan, cherry and apricot stones from Rome and Naples, Lupine seeds from Pompeii, Persian violet, cotton ball from Elephanta, Bombay, seed from India, *Casuarina* Equisiti folia (India), tree seed from Bombay, tobacco from the Nile, seed, orange seeds from Joppa, corn from the Nile (fourteen parcels in all), shell money, *cypræa moneta* (India), seven parcels of insects from India, Egypt and Italy, wheat from the valley of the Nile. From Henry Hemphill, the following Crustacea: *Cancer antennarius*, three specimens; *C. productus*, one; *Xantho spinituberculatus* (n. s.), one; *X. novemdentatus* (n. s.), one; *Xanthodes latimanus* (n. s.), one; *X. leucomanus* (n. s.), five; *X Hemphilliana* (n. s.), one; *Speocarcinus*, *Californiensis* (n. s.); *Randalia ornata; Lupa bellicosa; Acanthus spino-hirsutus* (n. s.); *Dermaturus Mandtii; Microrhynchus Hemphillii* (n. s.); *Inachus tuberculatus* (n. s.); *Fabia subquadrata*, two; *Pugettia Richii; Pisoides tumidus* (n. s.); *Pseudosquilla marmorata* (n. s.), one; *Alpheus equidactylus* (n. s.), one; *A. bellimanus* (n. s.), two; *Hippolyte palpator*, one; *H. cristata*, one; *H. Hemphillii* (n. s.), one; *Idotæa rectilinea* (n. s.), one; *Lambrus frons-acutis* (n. s.); *Scyra acutifrons; Crangon nigromaculatus* (n. s.), two; *Callianassa longimana*. From Henry Edwards, *Panulirus interruptus, Idotæa resecata, Hippolyte lineata, Acalephæ, Amblystoma, Sceloporus, Gasterosteus, Chiropsis guttatus, Orchestia Traskiana, Livoneca vulgaris*. From Mr. Curtis, through C. M. Kinne, *Ostracion*, sp? From the California Pioneers, one hundred and fifty specimens of ores and minerals. From Henry Edwards, precious garnet in mica slate. From W. N. Lockington, Sillimanite. From J. F. Jerome, minerals and ores. From Gov. S. Purdy, silver ore. From Holmes and Dawson, specimens of marble. From Prof. Davidson, *leucite* (white garnet). Ivory and palm nuts from the California Pioneers.

W. N. Lockington read the following description of twenty new species of Crustacea from California:

Remarks on the Crustacea of the Pacific Coast, with descriptions of some New Species.

BY W. N. LOCKINGTON.

Notwithstanding the small number of sheltered bays and coves to be found along the shores of the Pacific Ocean, south of Vancouver's Island, the Crustacea appear to be tolerably abundant, since the total number of species of the two highest orders, (the stalk-eyed and sessile-eyed) known or described up to this date, is about two hundred and twenty, and there is every reason to believe that a more searching investigation would at least double that number.

Neither Dana nor Stimpson did much work at the Crustacea south of San Francisco, and the species lately described by Smith are almost entirely from Panama. Between Panama and San Francisco lies a vast extent of coast, extending through nearly twenty-nine degrees of latitude, and embracing a region greatly diversified in climate and productions, so that although many San Franciscan species extend southward a considerable distance, and many Panama species may range along Central America, it is but reasonable to suppose that many undescribed forms have their limits between those extremes.

The reasonableness of this expectation will be rendered the more apparent by a glance at a map showing the ocean temperature. That portion of the ocean bathing the shores of California at San Francisco, belongs to the subtemperate oceanic zone included between the isothermal lines of 50° Faht. and 56° lowest cold, but the heat of the ocean increases rapidly as we travel southward, so that the coast from Monterey to San Diego, and for some distance south of the latter place, lies between the isothermal line of 56° extreme cold and that of 62°. The greater part of Lower California, with the Gulf, is included within the line of 62° extreme cold and that of 68°, and may be called warm temperate. From Cape St. Lucas to about the latitude of Acapulco is the sub-torrid zone, the isothermal line of 74° degrees lowest cold bounding it toward the south, and forming the northern limit of the torrid oceanic zone which extends to, or near to, Guayaquil, in the State of Ecuador.

Since Panama is situated close to the oceanic heat equator, it will be seen that in the 29° of latitude between San Francisco and that place there is a variation of about 30° in the lowest temperature of the ocean, a difference which must and does imply a corresponding variation in the animal life inhabiting the ocean.

It was, therefore, with great pleasure that I received, since our last meeting, a small but choice collection of Crustacea, collected at Monterey and San Diego, by Mr. Henry Hemphill, and my pleasure was still greater when I found, upon comparison with the specimens already in our museum, and with the writings of Stimpson and S. I. Smith, that this donation enriched us with at least 20 species new to science.

Up to this present time no species of Crustacea from Panama, and only one or two from the coast intervening between that point and San Diego,

have reached this Academy, and the amount of zoölogical riches yet remaining to be harvested in this quarter, may be guessed at from the fact that these twenty species were collected incidentally, as it were, the Crustacea not being the chosen field of the collector.

It is with some diffidence that I refer some of these species to their genera, simply because we have not in our collection specimens of many well known genera, nor have we in our defective library any figures or description of the already known species included in them.

To make clear to others the difficulty under which I and any other person who attempts to do a little original work in connection with this institution, are compelled to labor, I have but to state that two of the species described in this paper belong to a group of crabs, the *macropodidae* (distinguished by the great length and thinness of their legs), no species of which has before been known on this coast, but of which the typical forms are described and figured in such standard works as those of Milne Edwards, and Bell's British Stalk-eyed Crustacea, neither of which works are to be found in our library.

I have, therefore, in determining the genera, been compelled to be guided alone by the generic descriptions given by Dana in his Crustacea of U. S. Exploring Expedition, the only comprehensive work accessible to me, and that is lent to the Academy.

Before proceeding to the technical description of the new species, I wish to draw the attention of all members of the Academy at all interested in zoölogy, to a few peculiarities in our list of native Crustacea as it stands at present.

Two species of Macropodidae, as I have just said, are all that are yet known. The crabs of this tribe are sluggish in their habits and are usually found among sea weed, sponges and zoöphytes, at depths below those left bare at the lowest low tide, and are thus only obtained by dredging, unless cast ashore in some storm along with the sea weed among which they live. It is, therefore, almost a certainty that a properly organized search would disclose several other species, even in this immediate neighborhood.

Of the *Xanthidae*, a sub-family near the true *cancer*, not a single species has been described by Stimpson or Dana, and it is singular that among the newly found San Diego species this tribe predominates.

Only two species of the swimming crabs (*Portunidae*), have yet been found in California, one of these (*Lupa bellicosa*), has been described by Stimpson, and the other is new.

The parasitic Crustacea of various orders have not yet been collected with any thoroughness, but I may here mention that several, (so far as I am aware) undescribed forms have recently been added to our collection, and that I hope, during the course of this year, to be able to prepare another paper upon them and upon other undescribed species not included in the present paper.

Neither the Entomostraca, which include the *Cyclops*, *Cypris*, *Daphnis*, and many other tribes, nor the Barnacles or Cirripedia of this coast have yet been studied, and I trust that this short ennumeration of a few of the things that want doing may stir up some of our members to do them.

The collection of Crustacea in this museum now includes about 320 species, almost all from this coast or from the islands of the Pacific. Scarcely any

European or Atlantic coast species, and none from South America, Australia or Africa, have yet reached us.

I have purposely made my technical descriptions short, giving only those salient characteristics which distinguish the species, but it is my hope to supplement these descriptions by a series of photographs of the new forms—a hope warranted by the present financially satisfactory state of this institution.

Inachus tuberculatus.

Rostrum, short, entire; pre-orbital spine marked only by the angle of the orbit; post-orbital spine slightly longer than the eyes; medial region of carapace with several small tubercles; posterior, with a large central tubercle surrounded by a ring of smaller tubercles; postero-lateral regions, with several small tubercles; all the regions prominent and separated by well marked depressions; three last joints of first pair of feet with scattered tubercles, manus stout; second pair of legs 2½ times the length of the post-rostral part of the carapace; sternum and abdomen with scattered tubercles.

Dimensions of two specimens:

	Length.	Width.	Length of 2d pair.
Male..............................	0.75	0.55	1.55
Female.......	0.56	0.38	0.94

Dredged in eight fathoms, upon a rocky bottom covered with weeds, at the mouth of San Diego Bay, by Henry Hemphill. This, and the following species, are the first examples of the *macropodidae* found on the California coast.

Microrhynchus Hemphillii.

Rostrum, short, entire; form of carapace, long and narrow triangular; post-orbital spine, small; antero-lateral margin marked by a line of hairs; 1st pair of legs short, the meros extending to the line of the eyes; 2d pair, more than three times the length of the post-rostral part of carapace; 3d, 4th, and 5th pairs diminishing in length, the last a little less than twice the length of post-rostral part of carapace. A few scattered hairs on the two last joints of the four hinder pairs of legs, especially on the fourth joint.

A single male specimen of this species was dredged in seven fathoms of water, in the Bay of San Diego. Length, 0.75; width, 0.33; length of 2d pair of legs almost two inches.

Pisoides? tumidus.

Rostrum, bifid, moderately long; no pre-orbital spine; post-orbital spine small; first joint of external antennae very wide, prolonged into a point externally. 1st and 2d pair of legs about equal in length; hand of first pair, stoutish; fingers gaping when closed, the ends toothed and fitting neatly together; a large tubercle on movable finger in the centre of the gaping part. Carapace, with the regions tumid and spineless, smooth and rounded behind. A single specimen, male, was found between tides, near San Diego. The whole of the carapace and feet are covered with a short pubescence, becoming

longer upon the margins of the limbs and forming a lamellate protuberance over the rostrum. Length, 0.65; width, 0.45; length of 2d pair of feet, 0.80.

Lambrus frons-acutis.

Carapace, transverse, somewhat pentagonal, each antero-lateral border having a rounded angle in the centre of its length; and the postero-lateral border forming an almost straight line with the posterior border. Rostrum, pointed, prominent, elevated, continuous with the elevated gastric region. A prominence at the cardiac region. Branchial regions prominent, each capped with a line of tubercles extending outward to the angle between antero and postero-lateral borders. Antero-lateral border finely toothed and terminating behind in an acute point. The portions of the carapace between the prominences are much depressed and perfectly smooth. Arm, carpus and hand of the first pair of legs, trigonal in section, each angle set with a continuous row of small tubercles. Dactylos turned inwards almost perpendicularly to the hand, very small. A single dried specimen brought from Santa Catalina. Length, 0.50; breadth, 0.70; breadth across arms when bent, 1.33 inch.

Xantho spini-tuberculatus.

Front four-lobed, areolets of anterior and antero-lateral portions of carapace prominent; six teeth on antero-lateral margin, including that of posterior angle of orbit; chelipeds covered with smooth shining tubercles on the upper portions, those of the hand arranged in seven longitudinal series; fourth and fifth joints of the four hinder pairs of limbs beset with spines on their superior portions.

Specimens from Santa Rosa, presented and collected by W. G. W. Harford.
Specimens from Monterey, presented and collected by J. G. Cooper.
Specimens from San Diego, presented and collected by Henry Hemphill.

Length of carapace of male,	0.44	width, 0.63
" " female,	0.38	" 0.57

Xanthodes latimanus.

Front sinuate, the inner angle of the orbit raised into a point; carapax but slightly transverse; teeth N. T. S., prominent and pointed, D and E almost obsolete. Areolation of medial and antero-lateral regions distinct, the former having the parts 2 M, and 3 M entirely outlined. Hands, sub-equal, the right somewhat the larger; movable fingers very long, and curved abruptly downward; margin of manus continuous with the broad base of the fixed finger so as to form a sinuous sloping line; hinder feet compressed. This species may be readily identified by the delicate marbling of the carapace and chelipeds, and the downward bend of the movable fingers. Abdomen of male, five jointed.

A single male specimen from San Diego. Length, 0.73; breadth, 0.88.

Xanthodes Hemphillii.

Front almost entire, slightly waved and somewhat produced; carapace, transverse, medial region prominently outlined; 1st antero-lateral tooth (D),

almost obsolete; 2d, (E), long and low; 3d, (N), 4th, (T) and 5th, (S), pyramidal and pointed; cardiac region faintly outlined. 1st pair of feet, subequal, smooth; hands without crests or tubercles; fingers, black. The movable finger of the right hand with a large tubercle at base; 3d, 4th and 5th joints of four posterior pairs of feet compressed, fingers villous.

A single male specimen found at Monterey. Length, 0.82; width, 1.10.

Xanthodes leucomanus.

This species appears to be very nearly allied to *X. Hemphillii*, having the front antero-lateral teeth, and areolation of that species. If there is any value in the subdivision *Xanthodes*, both should be included in it, as both have the first antennal joint connected with the front by a process. The principal difference between the two forms, size excepted, will be found in the network of raised lines upon the upper portions of the hand and carpus of the chelipeds in the present form; and the almost entire absence of the tomentosity upon the four hinder pair, which characterizes *X. Hemphillii*. The dactyli of the chelipeds are of a shining, leucous tint when recent. Several specimens, from Santa Rosa Island (W. G. W. Harford); Monterey (J. G. Cooper); and San Diego (Mr. Henry Hemphill). The carapax of the largest specimen measures half an inch in width, and 0.34 in length.

Xanthodes ? novem-dentatus.

Front rather narrow, prominent in centre, and produced forwards; teeth of antero-lateral margin, nine in number; carapace transverse; chelipeds long, the right considerably the larger; manus long and rather narrow, with a slight double crest on the superior margin; corpus with several blunt spines; posterior feet somewhat compressed, with a few scattered hairs on the margins.

A single male specimen, from San Diego. Total length, 0.94; breadth, 1.25.

Acanthus. Nov. gen.

This genus is proposed for the reception of a singular species found at San Diego by Mr. Henry Hemphill. Its characters are: front, two-lobed, with a deep central emargination; antero-lateral margin, front, and whole circumference of orbit surrounded by long spines; carapax, narrow; antero-lateral and postero-lateral margins about equal in length; body, thick; abdomen of male, seven jointed. This genus appears to be near Pilumnus, but I can detect no trace of a praelabial ridge.

Acanthus spino-hirsutus.

Besides the generic characters given above, this species may be distinguished by ten spines upon the front, pointing straight forward; a group of four on each side the central emargination, and a single spine close to the outer antenna, the second joint of which reaches nearly to its extremity; six or seven spines on lower margin of orbit, and four larger spines on antero-lateral margin of carapax, besides those on upper margin of orbit. Front portion of carapace and upper parts of all the feet thickly covered with

long stiff hairs, mixed, on the chelipeds only, with spines similar to those of the front of carapace. The whole upper surface of the carapax, the meros of the fifth pair of feet, and the posterior portion of the sternum are covered with a short and thick pubescence. Right hand considerably the larger; fingers of both hands with several large, blunt teeth or tubercles on their inner margin. The spines upon the hands change gradually to tubercles as they approach the fingers.

Length, one inch; breadth of carapace, 1.12.

Eucrate? Californiensis.

Surface of carapace smooth, very slightly granulate close to margins; antero-lateral margin three-toothed; carapace level transversely, but considerably curved longitudinally; abdomen of male five-jointed; right hand considerably larger than the left; hand broad and thin; laminate on superior margin; carpus with a spine on the interior distal margin; four hinder pairs of legs rounded, tarsi pointed.

The aspect of this species is exactly that of Stimpson's *Speocarcinus Carolinensis*, as figured in Notes on North American Crustacea, No. 1, but the abdomen is different.

Width, 1.06 inch; length, 0.82 inch.

The only specimen (dried) is from San Diego.

Pseudosquilla marmorata.

Carapace much narrowed in front, as in *Squilla*, but the body stiff and without carinæ upon the thoracic or abdominal segments, except upon the two last. Penultimate segment with two central spines flanked on each side by two lateral ones; a central carina, and five lateral ones on each side of the apical segment of abdomen. The central carina terminates in a spine, flanked just beneath by the two movable spines, counting from which, on each side are, 1st, a small blunt spine; 2d, a small acute spine; 3d, a large acute spine; 4th, a very small acute one; and 5th, a bluntish spine formed by the union of the two outermost carinæ of the last abdominal segment; the penult joint of the caudal appendages armed with nine spines, the last as long as the last joint of those appendages; first joint of caudal appendages prolonged backwards into a spine almost as long as the remaining two joints, and armed on its inner edge with two strong spines; antennary plate produced into an acicular spine, movable finger with two spines only on its interior edge; three movable spines at proximal end of manus.

The whole of the upper surface of this rare and beautiful crustacean is marbled, in its dry state, with yellowish brown spots on a dark brown ground, while the tips of the caudal appendages are a vivid red.

Length, from tip of rostrum to tip of movable spines, 3.80 inches; of carapace only, 0.82 inch; width of abdomen, 0.63 inch.

This single specimen in this collection was found at low tide, on sandy mud flats at San Diego.

This and *Squilla De-saussurei*, Stimpson, are, so far as I am aware, the only Stomapoda yet discovered on the shores of California.

Crangon nigromaculata.

Carapace with a single spine on the gastric region near the rostrum, and a larger spine on each hepatic region. Suborbital and antennal spines present. Inner antennæ about equal in length to movable scale of outer antennæ, and the base of outer antennæ about half as long as its movable scale; Dactylos of first pair of feet transverse, short; an oval black spot on each side of the abdomen just anterior to the caudal processes.

Three specimens from San Diego, dredged in six fathoms of water.

Total length of largest specimen from tip of antennal scale to tip of tail, 2⅛ inches; of body from tip of rostrum, 2.06 inches.

This species can readily be distinguished from all others by the black spot upon each side of the tail; it appears to be nearly allied to *C. nigricauda*.—Stimpson.

Crangon Alaskensis.

Rostrum very short and pointed: spines of carapace, as in *nigromaculata:* inner antennæ scarcely as long as movable scale of outer antennæ; movable finger of first pair of legs rather long, oblique; hands, carapace, and abdomen in preserved specimens (alcoholic), clothed with minute black spots.

This species may be distinguished from *C. nigricauda*, which it much resembles, by the greater obliquity of the palm of the hand, the different coloration, and the smaller size.

Length of body, 1.45 inches.

Several specimens from Mutiny Bay, Alaska, presented by the U. S. Coast Survey.

Alpheus bellimanus.

At the time of the publication of Stimpson's Crustacea and Echinodermata of the Pacific Shores, no species of *Alphæus* had been detected in California, but recently two species have been collected by Mr. Henry Hemphill, of San Diego. The present species may be easily recognized by the beautiful coloring of its hands, which, in a dried specimen, are orange, with various spots and workings of black and white.

Movable finger of larger hand small, depressed, and closing in a plane oblique to that of the manus, which is furnished with a spine on its outer edge, and a second beneath, has a toothed margin opposed to that of the dactylos, and presents two longitudinal grooves on its under surface, the anterior groove terminating in a transverse depression: in the smaller hand the dactylos is laminate and in the same plane with the hand, which has an exterior spine like that of larger hand, and another on its inferior surface. The fixed finger of the larger hand is longitudinal, and has an almost straight edge; the annulations of the carpus of second pair are only four in number; there is no tooth on the lower apex of the third joint of the third and fourth pairs of legs.

Two specimens from San Diego, found among kelp.

Length of larger specimen, from joint of rostrum to end of abdomen, 1.20 inches; length of larger hand, half an inch, of smaller, 0.38.

The carapace presents traces of a similar coloration to that of the hands.

Alpheus equidactylus.

A single dried specimen, broken, from Monterey, is all that we possess of this very distinct species. The larger hand has a transverse sulcus immediately posterior to the finger, and the movable and fixed fingers are of equal length and extended in the same place with the hand. The rostrum is narrow and sharp.

Length, 0.75 inch. The fingers of the chelae shut close together when the hand is closed.

Betæus longidactylus.

Form much more compressed than in *alpheus bellimanus;* hands similar in form; long and compressed; the fixed finger half the length of the hand, the movable one more than half that length; the fingers when closed gape widely; both are pointed at the end, and the points cross each other like the mandibles of a *Loxia*. At the origin of the movable finger are several teeth, opposed to two large ones upon the hand itself, which also bears a large tooth in the centre of the length of the fixed finger.

Color of carapace of dried specimen, green, with nuances of russet and olive. The fingers of the larger hand are light red, the tips green.

Length of carapace, 1.12 inch; of larger hand, 0.56 inch; of smaller, 0.36 in.

A single specimen from San Diego, on a sandy mud flat, between tides.

Hippolyte? Hemphillii.

I give this provisional name to a single specimen (dried), brought from San Diego by Henry Hemphill. Several of the feet are wanting, and the specimen is distorted so as to render a detailed description impossible. The rostrum is short and has four teeth, besides the long terminal tooth. The limbs are banded transversely with alternate dark and light tints.

Length, 1 inch.

Hippolyte lineata.

Rostrum less than half the length of the carapace, armed with seven teeth on the upper side (including the terminal one), and three on the lower; the two hinder teeth only are on the carapace, and are longer, but not higher than the others; outer maxillipeds reaching to the tip of the movable scale of outer antennæ; hands of first pair small and slender. The most noticeable characteristic of this species is the presence of eight longitudinal lines of a tint lighter than the ground color of the body. Upon the carapace these eight lines become broken up, and mingled with other markings, producing a pattern resembling that of watered silk. Two dried specimens from San Diego, collected between tides, and one larger one, in alcohol, presented by Henry Edwards.

Length of largest specimen, from tip of rostrum to end of abdomen, 2¼ inches.

Idotœa rectilinea.

Body, slender; not increasing in width backwards; all the segments of the thorax equal in width, and the abdomen rectilinear, nearly as wide as the thorax; first two segments of abdomen, distinct; total length of abdomen about equal to that of last three thoracic segments; posterior extremity obtusely pointed. Thoracic segments equal in length. Outer antennae, long; the peduncle equal in length to the three first segments of body; flagellum broken in both specimens. Color, various; one dried specimen almost entirely black, the other with a black line down centre of body, the rest of which is yellowish.

Length, 0.80 inch. Width, 0.17 inch. San Diego.

Serolis carinatus.

Thorax and abdomen conspicuously keeled upon the centre of every segment; the first segment slightly waved on its posterior margin, the curve of the segments increasing rapidly, in such a manner that the last entirely encloses the free abdominal segments on their sides. Caudal segment rounded at the extremity, with two marginal teeth on each side, at a considerable distance from the extremity, the central carina running the entire length of the segment; last basal joint of inner antennæ longer than 'the flagellum; flagellum of outer antennæ much shorter than either of the two of the preceding basal joints, and last basal joint about equal in length to the penultimate. Eyes large, reniform, conspicuous. The texture of the upper surface of a dried specimen, under a two-thirds power, has a somewhat squamate appearance. Color, a grayish brown, diversified with dots and irregular markings of black; hands long and slender; dactylos equal in length to the manus.

Two specimens from San Diego. Length, 0.21 inches; width, 0.16 inches.

T. A. Blake read portions of a petition to Congress, from the Boston Society of Civil Engineers, relating to the adoption of the Metric system of weights and measures.

On motion, the Chair was requested to appoint a committee in regard to the memorial.

The Vice-President informed the Academy that Dr. Gerhard Rohlfs had kindly consented to lecture before the Academy upon his travels in Africa during the years 1860 and 1867; the lecture to be delivered the Monday following this announcement.

On motion of Dr. Stout, Dr. Rohlfs was invited to become the guest of the Academy during his stay in San Francisco.

The judges of election reported having duly filed the certificate of election with the County Clerk.

Regular Meeting, February 21, 1876.

In the absence of the President and Vice-Presidents, Dr. Henry Gibbons was called to the Chair.

Nineteen members present.

Chas. F. Dio Hastings was proposed as a life member.

Donations to Museum: J. G. Lemmon of Sierra Valley presented twenty-five specimens of plants. T. J. Butler, of Arizona, presented a number of minerals. From Henry Edwards specimen of *Chiropsis nebulosus*. From Mr. Harford, *Clypidella Callomarginata* and parasite worm on *Glyphis aspera*. Ascidian from Santa Rosa Island, *Vermes* from Santa Rosa Island, common under stones. From Mr. Baldwin, *Lysiosquilla*. From Gen. Cobb, *Pelecanus erythrorhynchus*.

On the first of March, 1875, at the regular meeting of the Academy, a box of minerals from Australia was presented by Mr. E. O. McDevitt, through Gen. John Hewston, Jr. Having no place to put them, the box was not opened until recently, and was found to contain forty-eight specimens of minerals, seven teen fossils, six photographs, and a map of the tin fields of Queensland—all of which were exhibited. Eleven of these specimens are gold-bearing, three of lead ores, eight of copper ores, two of cinnabar in quartz associated with blue and green carbonates of copper disseminated through the quartz—these two are handsome specimens; there are none like them in the museum; two of antimony ores, specimens of Herschelite (a variety of Gmelinite), bismutite (a carbonate of bismuth), drift in which diamonds are found; a very interesting series of specimens from the tin fields, comprising tin crystals in quartz, wash dirt in which tin is found, stream tin, pebbles from tin washings, a smoky quartz crystal from the tin washings tourmaline (or schoolsand, being worn grains called by the miners sham tin), titaniferous iron sand (also called sham tin), bed rock of lode tin with tin crystals, and metallic

The resignation of W. J. Fisher as Librarian was tendered, and referred to the Council.

On motion of Dr. Stout, a vote of welcome was passed "to our returned President."

General Colton, of the Board of Trustees, stated that a letter had been received by the Board from the Central Pacific Railroad Company asking the use of certain ethnological specimens for exhibition with their collection at the Centennial. Mr. Scupham, a member of the Academy, would have personal charge of the Railroad Company's collection, and would take equal care of the objects loaned by the Society. He moved that the articles be loaned for the purpose specified.

Mr. Scupham explained that it was intended to make as full a display as possible of Pacific Coast material, and the co-operation of the Academy would be of assistance—the Company's collection of ethnological specimens being meagre.

The motion to lend the articles asked for was then put and passed.

Regular Meeting, March 20th, 1876.

The President and Vice-Presidents being absent, Dr. Harkness was called to the Chair.

Forty members present.

Chas. F. Dio Hastings was elected a member.

J. K. Nelson was proposed as a candidate.

Donations to the Museum: From F. A. Walley, chloritic slate, Sonoma Co. From Governor Purdy, silver ore from De Leon mine, Sonora, Mexico, and gold quartz from Calaveras County. From Dr. J. M. Hill, quartz from Calaveras County, Cal. From Geo. H. Saunders, specimens of mineral resin, hematite (red ochre), larva and petrified wood. C. C. Bean presented silver ore from Peek Mine, Arizona. T. J. Butler donated specimens of calcareous tufa, argentiferous galena from Arizona.

The Secretary read a communication from the President, giving data concerning the solar eclipse of March 25th, 1876.

W. N. Lockington presented a second paper "On the Crustacea of California," containing a description of seventeen new species.

Description of Seventeen New Species of Crustacea.

BY W. N. LOCKINGTON.

Platypes, nov. gen.

Rostrum simple, post and pre-orbital spines wanting, hinder feet laminate.

Platypes edentata. nov. sp.

Rostrum laminate, triangular, simple; carapace tuberculate, the tubercles not prominent, and each covered with smaller tubercles.

Form of carapace broad. pyriform; antero-lateral margin not well defined, indistinctly lobed; postero-lateral and posterior margins forming a continuous curve, without spines or projections. Eyes not projecting, rostrum and antero-lateral margin forming a continuous line.

Propodus of first pair smooth, oblong; fixed finger and dactylos closing only at the tips, which are somewhat spoon-shaped, manus with an alveolate upper edge. Hinder four pairs broadly laminate.

Length of largest specimen, a female, 0.44, greatest width, 0.38.

Three specimens of this small and curious species from Mazatlan, presented by Hy. Edwards. Not having seen anything similar, or met with any generic description which seems to apply in every respect, I propose to make it the type of a new genus.

Ätergatis cristatissimo.

Carapace transverse, elliptic, the front and antero-lateral border forming the greater portion of an ellipse, the front not projecting beyond the line of the ellipse. Antero-lateral margin cristate, the crest divided by short sulci into four lobes, of which the 2d is short, the 1st and 3d long, and the 4th turns somewhat abruptly inwards, the crest ending half way along the postero-lateral border, which is short and only slightly concave. Front slightly waved. Areolation distinct upon the central and antero-lateral regions, but becoming obsolete posteriorly.

Chelipeds about equal in size, manus with three distinct low beaded ridges on the outer side, and a sharp crista above, the latter continued along the carpus. Fixed finger short, with a long sharp tooth on its inner face. Dactylos cristate above, inserted some distance below the upper margin of the manus. The fingers are pointed at the ends, and knife-like on their inner edges. Hinder limbs cristate, compressed, claws long and sharp. Color

(dried specimens) a bright vermillion red throughout, except the fingers, which are brown.

Length, 0.50; width, 0.70.

The specimens are from La Paz, Lower California, and were collected and presented by Dr. D. E. Hungerford.

Xantho multidentatus.

Areolets of anterior part of carapax distinct. 1 M confluent with 2 M, which is partially cleft by a furrow; all the antero-lateral areolets (1, 2, 3, 4, 5, 6 L) distinct; also, the postero-lateral (1, 2 and 3 R) and posterior (1, 2 P) sufficiently distinct to be made out.

The projecting lateral teeth are the normal ones, D being simple, E and T double, N and S triple. The upper margin of the eye is enclosed in a semicircle of teeth, the outer of which is the first of the antero-lateral series. Two teeth intervene between the outer tooth and the front, which is four-toothed, and deeply emarginate in the centre.

Upper parts of hand and carpus covered with sub-seriate tuberculations. Posterior feet short, compressed, cristate.

The single dried specimen, a male, shows traces of a dark purple tint on the carapax and anterior feet.

It was collected at Mazatlan, by Mr. Hy. Edwards.

Acteodes Mexicanus.

Carapax smooth, unarmed, transverse, wide, antero-lateral border forming, with the front, the greater part of an ellipse. Teeth of antero-lateral border reduced to slight curves. Front somewhat waved, and slightly projecting beyond the general curve of the ellipse.

Areolets indistinct throughout, yet the median can be distinguished from the antero-lateral. The sulcus between the gastric and cardiac is well-defined, and most of the sub-regions can be made out. Postero-lateral border only slightly concave, forming a very obtuse angle with the posterior border.

Right cheliped the larger. entirely unarmed, smooth; fixed finger with two large tubercles on the inner face, dactylos with two large and two small tubercles; the fingers not spoon-shaped, gaping, and touching at the points only. Left cheliped smaller, and differing from the right in the fingers, which fit pretty closely throughout their length, tips spoon-shaped.

Hinder limbs smooth, w ak, slightly heavy in the last two joints.

A single male specimen from Mazatlan, collected and presented by Mr. Hy. Edwards.

Length, 0.56. Width, 0.80.

The general color of the dried specimen is a dull reddish brown, inclining to red on the under side of the chelipeds. Fingers dark brown.

As the fingers of the smaller hand are distinctly spoon-shaped, I have called this an *Acteodes*, but it is evidently a connecting link between that genus and *Actæa*.

Amphitrite Edwardsii.

Inter-antennal front four-toothed, the teeth rounded, and the central emargination by far the deepest. A deep sinus between the front and the pre-orbital tooth, which is two-lobed; thus there are altogether eight teeth between the eyes. Antero-lateral margin nine-toothed, the teeth alternately large and small, commencing with a post-orbital. Meros of left cheliped (the right is wanting in our specimen) with four teeth on the inner margin, the tooth next carpus much smaller than the others. Carpus with a long spine on the inside, and four spines on the outside. Manus with three spines above, and three rows of small tubercles on the outside. Fingers sulcate, tuberculate on inner border. Two transverse ridges across the carapax, one in the center of the length, divided into three portions by the sulci separating the central region from the antero-lateral ones; the other shorter, crossing the central region in its widest portion. These ridges are beaded.

Length, 0.87. Width, 1.25.

The specimen is a male, and was brought from Mazatlan by Mr. Hy. Edwards. This, and *Lupa bellicosa* Sloat, are the only Portunidæ yet known on the Pacific Coast north of Central America.

Betæus equimanus. n. s.

Base of inner antennæ three-fourths the length of base of outer antennæ, flagella about half as long as those of the external antennæ. Outer appendage of inner antennæ about two-thirds as long as the inner. External antennæ considerably more than half as long as in the body. Outer maxillipeds as long as base of inner antennæ. Hands of first pair of legs about equal in size, oblong ovate; dactylos with a sharp recurved point, and a straight cutting edge margined with setæ; the cutting edge is opposed to a similar straight cutting edge, also margined with setæ, on the palmar surface, which also ends in a sharp incurved point. The fingers gape somewhat at the proximal end, where they are tuberculate. Second pair of feet slenderer than the third and fourth; but not much longer.

Front curvately emarginate between the eyes, which are clearly visible through the projecting part of the carapace. Carapace recurved. Body considerably depressed. Epimera (Coxæ) of second abdominal segment large, overlapping those of the adjoining segments.

Length of larger specimen, 1.05.

Two specimens, both females with ova, which in one case are large and evidently mature.

This species lives under the mantle of *Haliotis rufescens*, and the specimens were procured at Catalina Island by S. A. L. Brannan. Color in alcohol, a light flesh color, the liquor itself taking the same tint; when fresh, a dark purple.

Alpheus clamator.

Front tri-spinose, the largest point forming the rostrum, and slenderer than the others, from which it is separated by a deep sulcus; the lateral spines quickly widening out into a shield curved closely over the eye. Carapace

smooth, body not greatly compressed. Epimera of second segment overlapping those of preceding and succeeding segments.

Flagella of inner antennæ about half as long as body, those of outer antennæ more than three-quarters as long as body.

Hands of first pair of legs dissimilar both in size and form. Fingers of smaller pair straight, parallel and slender, closely fitting; the manus with a spine above, and a constriction posterior to the insertion of the dactylos. Manus of larger or right hand large, with a large spine on the outer side, continued as a carina for a considerable distance backwards, and with a deep sulcus above the carina. Dactylos short, curved obliquely downwards, thick and swollen at the extremity. A deep transverse sulcus between the dactylos and manus, ending in an oblique longitudinal sulcus having its origin on the upper edge of the manus; from the latter sulcus a second transverse one is continued down the inner side of the manus.

Both hands setose, the hairs long and numerous.

Carpus of second pair five-jointed, third and fourth joints shortest, the manus and dactylos slender.

Length, 1.05.

Color, in alcohol, a light flesh tint, much deeper on the large hand. A darker spot on the upper surface of the carapax, also on the anterior edge of the two first abdominal segments.

This species lives in pools on rocky reefs at low-tide level, and is capable of producing, by clapping together the fingers of the larger hand, a snapping noise like that which can be made with the finger-nail.

Collected at Santa Barbara Island by S. A. L. Brannan.

Idotæa pulchra.

Body stiffly articulated. Cephalic shield emarginate in centre of front forming two lobes.

First thoracic segment concave in front, advancing around the head; first four thoracic segments sub-equal in length; 3d and 4th about equal in width; three hinder thoracic segments much shorter. Abdomen one-jointed, one short partial suture on each margin near thorax, tapering to posterior extremity, which is narrow, but concave. Margins of all the thoracic segments deflected outwards horizontally.

Flagellum of outer antennæ not quite as long as base, 16-jointed, base somewhat setose. Inner antennæ very short.

Length 1.15 in , breadth 0.52 in.

When recent, the coloration of this species is very beautiful, consisting of red cloudings on a lighter ground.

The two specimens. male and female, in this collection were brought from the W. coast of Alaska, N. of Bhering's Strait, by W. J. Fisher, Naturalist of the U. S. S. *Tuscarora*, Deep-Sea Sounding Expedition.

Idotæga. nov. gen.

Last pair of abdominal appendages operculiform, and concealing all the preceding pairs, as in *Idotæa*, but with four posterior pairs of legs, with

small claws, and the three anterior pairs sub-dactyle, as in *Pterelas* in the family *Ægidæ*.

Idotæga longicauda.

Thorax increasing in width to the central segment, length of segments nearly equal, the posterior slightly shorter. Cephalic shield deeply emarginated at sides, each border forming two blunt teeth. Epimera large, pointed, extending behind their respective segments, the backward curvature increasing with each successive segment. Abdomen at origin as wide as thorax, first three segments pointed on each side, the point directed backwards; fourth segment narrower and shorter than the others, and enclosed laterally by the third; terminal segment very long, more than one-third the total length of animal, and gradually diminishing to a truncate point.

Eyes remote, inconspicuous. Flagellum of external antennæ nine-jointed. First joint very long, flagellum about equal in length to base, which is hirsute on interior margin. Internal antennæ reaching to near middle of ultimate basal joint of outer antennæ. First three pairs of legs sub-didactyle, with a short hatchet-shaped process on the joint preceding the manus, which is broad and margined with short hairs on palmar border. Four posterior pairs of legs with short stiff hairs on the upper margin of 3d, 4th, and 5th joints.

Two specimens showing a slight difference in the form of the caudal segment, which in the smaller specimen has an obtuse angle on each lateral margin, at about one-third of its length from the extremity.

Length of large specimen, 2.80 in.; greatest breadth across epimera, 1.00 in.

Length of smaller specimen, 1.80 in ; greatest breadth, 0.66.

The larger one was found by Capt. T. W. Williams, in lat. 67.30 N., long. 163.02 W., near the coast of Alaska. The smaller specimen was found by J. W. Fisher.

The larger is a skeleton only, the smaller, a male, in alcohol.

This species is totally distinct from any yet found on the Pacific Coast, but, since it occurs so far to the north, it is possible that it may be identical with some previously described species from the Arctic waters of the northeast of America.

Sphæroma olivacea.

Cephalic shield curved anteriorly, distinct from the first thoracic segment, which is but slightly longer than either of the succeeding four segments; last two thoracic segments very short. Abdomen with two distinct joints, the first marked with two partial sutures; the hinder segment curved posteriorly; caudal process not reaching beyond the caudal segment.

Length, ⅓ of an inch.

This species is exceedingly common in the lagoons of the salt-marshes at Fort Point, San Francisco, where it resides among weeds, or adhering to the underside of sticks, etc.

The chief distinctions between this species and *S. Oregonensis* as figured by Dana, are the more projecting cephalic segment, and the small size of the two hinder thoracic segments.

Æga Harfordii.

Sides of thorax almost straight, segments sub-equal. Cephalic shield rounded in front, eyes conspicuous, situated at the postero-lateral angle of shield. Abdominal segments five or four, last segment pointed. Exterior antennæ more than half the length of body, flagellum more than twice the length of base, many-jointed.

Epimera of all the thoracic segments except the three first, pointed behind, and extending further back than the segment to which they are attached. Claws of first three pairs of legs comparatively feeble.

Length, 0.63 in.

Collected at Santa Rosa Island by W. G. W. Harford, under stones at mid-tide in muddy places. Numerous.

Æga alaskensis.

Body broadest at 5th thoracic segment, sides regularly curved, 5th and 6th thoracic segments greatly larger than first four thoracic segments, 7th segment longer than 4th.

Head pointed in fronted, the sides continuing the curve of the thoracic segments. Epimera of 4th segment pointed posteriorly, as are also those of 5th, 6th and 7th thoracic segments.

First four segments of abdomen concave posteriorly, and ending laterally in a point directed backwards; 5th segment with a straight posterior margin, pointed at sides; terminal segment a half oval.

Eyes large, conspicuous, not projecting. Antennæ short, the outer reaching to the suture between 1st and 2d thoracic segments; flagellum about equal in length to base. Last four pairs of legs somewhat spinose.

Color (in alcohol) 4th, 5th, 6th and 7th thoracic segments dark brown, a little dark brown on posterior part of 4th and 5th abdominal segments, rest of body yellowish; egg-case dark brown.

Three specimens, all females, taken from codfish caught in Ounimak Pass, Alaska, lat. 54° 40′, long. 165°, by Capt. T. W. Williams.

Length of largest specimen, 1.30 inch; greatest breadth, 0.48 inch.

Lygia septentrionalis.

Two posterior thoracic segments much shorter than the anterior ones, and greatly curved. Caudal stylets short, about half as long as abdomen.

Outer antennæ about half as long as body, flagellum with twelve somewhat oblong joints, somewhat shorter than base. Cephalic shield with a waved, somewhat two-lobed posterior margin.

Length, without caudal stylets, 0.80 in. Width, 0.45.

The sides, from the second to the sixth thoracic segment, are almost parallel. Two specimens from Tanaga, one of the Aleutian Islands, presented by Mr. W. J. Fisher, naturalist of the U. S. Exploring Ship *Tuscarora*.

The general facies of this species is very like *L. occidentalis*, but it is easily distinguished by its short posterior stylets.

Caprella tuberculata.

Inner antennæ long with a fringe of long setæ on their underside; second, third and fourth joints about equal in length. Outer antennæ without setæ, almost as long again as inner ones: flagellum somewhat larger than the two last basal joints; second basal joint larger than the preceding or succeeding ones; the entire base not quite as long as inner antennæ.

Propodus of 1st and 2d pairs oblong ovate, without teeth or spines, dactylos long and slender, fitting close to palmar surface. Manus of second pair spinose at extremity. Branchiæ short and thick.

2d, 3d, 4th and 5th segments long, sub-equal, the 1st segment somewhat shorter, the 6th and 7th very short. The whole of the dorsal surface sparsely covered with small sub-spinose tubercles.

Length of a large female, 0.90: ditto, from extremity of larger antennæ to top of posterior dactyli, 1.75; of outer antennæ, 0.56; of inner, 0.30 in.

Several specimens, chiefly females, were brought from Icy Cape by Mr. W. J. Fisher, who procured them by dredging, at a depth of from seven to fifteen fathoms.

Megalorchestia franciscana.

Body smooth; superior antennæ one-third longer than the body, the flagellum longer than the base, with about thirty-five oblong joints. Superior antennæ reaching to middle of 2d joint of inferior. Second epimerals longer than deep, fifth short, bi-lobed. Anterior feet unguiculate, joints scabrous. Hand of second pair very large, oblong ovate, with an almost transverse palm, having a low oblong tooth near centre of palm. Dactylus much curved, touching palm at point only when closed.

Length of body, 0.87; of inferior antennæ, 1.15 inch.

A single specimen of this species was found by myself among the debris at high-tide level, Alameda Co., Cal.

The antennæ in the recent specimen were red.

This amphipod resembles *O. scabripes*, Dana, but differs from the figure of that species in Dana's work in the greater number of joints of the inferior antennæ, the shape of the tooth of the hand, and the proportion of the second epimerals. From *M. Californiana*, Brandt, it differs in the short fifth epimeral, and the scabrosity of the feet.

Œdicerus Behringiensis.

Cephalic shield rostrate, the rostrum about one-third the length of superior antennæ, curved downward, pointed. Eyes moderately large, contiguous. First six thoracic segments much shorter, with a slightly raised keel in the centre of each. Seventh and abdominal segments long, the seventh thoracic and two first abdominal with the carina divided into two sub-equal teeth, the third abdominal with a long low carina ending in a spine posteriorly.

Fourth epimeral much longer than the fifth. Superior antennæ about three-fourths the length of the inferior; flagellum twice the length of last basal joint. Inferior antennæ about one-third as long as the body, proportions like those of superior. Hands of first two pairs of feet oblong ovate, palms nearly

straight, dactyli long, fitting close. Seventh pair of feet larger than the others, but not extending much beyond the end of the caudal stylets, which are nude.

Length from end of rostrum to end of caudal stylets, 1.25 in.

Four specimens from West coast of Alaska, North of Behring's Straits.

Presented by the Alaska Commercial Company.

Lysianassa Fisheri.

Segments of thorax about equal in length, smooth; third segment of pleon one-fourth longer than the second, with a well-defined sinus on the posterior margin, bounded by a sharp tooth below.

First epimera larger than two succeeding pairs, and extending forwards at their lower portion; fourth epimera largest. First joints of superior antennæ very stout, touching each other, so as to appear a prolongation of the cephalon; second joint very short and stout.

Length, including stylets, 1.38 in.

A single specimen of the above species was obtained on the West coast of Alaska, and presented to this museum by W. J. Fisher.

As the specimen is unique, and dried in such a way that the four first pairs of feet are folded together within the epimera, it is impossible to describe them.

Mr. Gruber read the first of a series of popular papers on Ornithology, illustrating his remarks with appropriate specimens prepared by himself.

Regular Meeting, April 3d, 1876.

President in the Chair.

The following propositions for membership were received:

Albert Arents, C. A. Lockhardt, Louis Falkenau, H. W. Reese, Emlen Painter.

Donations to the Museum: From C. B. Turrill, specimens of *Batrachoceps attenuatus*, *Gerrhonotus*, *Actinemys marmoratus*, *Plestiodon*, sp., *Bufo Columbiensis*, trout from Donner Lake, *Bryttus*, Myriapods, *Arachnidæ*. From Henry Edwards, specimens of *Diemyctylus torosa*, twenty-seven specimens of *Myriapoda*, and sp. of *Pseudobdella*. From W. N. Lockington, specimens of *Asterias*.

From A. W. Saxe, borings from artesian well at Santa Clara. From Capt. Thos. W. Williams of whale ship Florence, eyes of the *Balæna Mysticetus* and *B. Sibbaldius*. From F. Gruber, specimens of barred owl (*Syrnium nebuloseum*) mottled owl (*Scops Asio*), and Carracara eagle (*Polyborus thaurus*). From Henry Edwards, *Dyadophis mirabilis*. From Col. Geo. E. Gray the following mollusca, *Anodonta Californiensis*, *Physa humerosa*, *Tyronia Clathrata* (Stmp.), and *T. protea*. From Henry Hemphill, specimens of new species of brackish water mollusk, *Paludinella Newcombiana*, with descriptions. Also *Alexia setifer* from Eureka, H. B., a shell forma also on China, but possibly introduced on this Coast by the Chinese.

Description of a New California Mollusk.

BY HENRY HEMPHILL.

Paludinella Newcombiana. Hemphill.

Shell thin, turbinate with four or five rounded whorls; apex sub-acute, last whorl somewhat inflated, subrimate, with or without three or four longitudinal brown bands; aperture ovate, outer lip thin, inner lip appressed to the columella and somewhat thickened; suture deep; epidermis greenish.

Operculum with nucleus sub-central with $2\frac{1}{2}$ whorls.

Length of largest specimen, $\frac{3}{8}$ inch.

Breadth of largest specimen, $\frac{3}{16}$ inch.

Habitat, Humboldt Bay, California.

I found this shell quite abundant on the Salt Marshes surrounding Humboldt Bay, California, associated with *Alexia setifer Coop.*, and *Assiminea Californica Coop.*, both of which are also abundant.

I take great pleasure in naming this species after my old friend Dr. W. Newcomb, well-known to the Scientific world, to whom I am much indebted for aid in my conchological pursuits.

W. N. Lockington read a paper on the anatomy and classificarion of Echni or sea urchins.

Dr. Kellogg described a new species of the order Compositæ, which he named Brickellia multiflora:

Brickellia multiflora.

BY DR. A. KELLOGG.

Stem 1—2 feet, woody, perennial, white, striated, erect; heads very small, (about five lines long,) 3—4-flowered, compound leafy racemes panniculately

massed, oblong-pyramidal, terminal and axilliary racemelets clustered; leaves alternate, short petiolate, ovate-oblong, corneous, acute, entire (or sub-entire,) triplinerved, impressed glandular alike above and below, varnished and viscid, strongly recurved. Involucre 3—4-flowered, scales in 4—5-series, outer shortest, ovate, acute, varnished, viscid, granular and glandular, intermediate lanceolate, oblong, acute, scarcely puberulent, deeply striate-nerved, interior linear, elongated, mostly obtuse scarious, longer than the pappus, shorter than the corolla; corolla ochroleucous, five-toothed border expanded, branches of the style exserted obtuse, clavate, glabrous; pappus white, single, very minutely villous, much shorter than the corolla; achenia 10-striate, striæ sparsely pubescent.

On dry rocky ledges of Sierra Nevada Mountains. Two or three feet high, spire shaped top; leaves varnished alike above and below, 1--2 or more inches long, ½—2 wide. Myriads of flowerets with thread-like branches of styles protruding, give it a yellowish hue, and the inner elongated scales glistening with white, so spangle the eye as to give it a peculiar arid appearance, notwithstanding the varnished green leaves intermixed.

President Davidson gave a very interesting account of the irrigation works now in course of construction in British India. The paper was accompanied by maps and diagrams.

Dr. Hale of New York mentioned a curious case of mimicry observed by him in the Santa Cruz Mountains, viz: a small spider exactly resembling the flower of the *Madroña* in color, size and form.

REGULAR MEETING, APRIL 17TH, 1876.

President in the Chair.

The following new members were elected: S. Lubeck (life), Joel F. Lightner, T. Bechtinger, J. K. Wilson, J. F. Meyers.

Robert Chalmers Lord was proposed as a candidate for membership.

Donations to Cabinet: Spider mimicking madroña flower, from Wm. Barber. Specimens of ore from Samuel Geddes, A. B. Stout, Barry & Patten, C. F. Kirchner, and Governor Purdy.

Captain C. Bryant, U. S. Treasury Agent to the Pribiloff Group of Islands, Behring's Sea, on the invitation of the President, gave an interesting description of the seal fisheries, and of the fur seal.

Regular Meeting, May 1st, 1876.

President in the Chair.

Thirty-two members present.

Edward P. Morse, Walter Damenburg and Rudolph Thormann were proposed for membership.

Donations to the Museum: Rock Salt from T. J. Butler; marmolite containing gold, from Gov. S. Purdy; silver ore, (South Barcelona mine) from Louis Blanding; silver ore, (Leopard mine) from Mr. Marshall, through Henry Edwards; ten specimens Amianthus; specimens of common salt; forty-five specimens of copper ore from Inyo and Placer Counties, argentiferous galena, flint nodule, from C. D. Gibbes; specimens roofing slate and purple slate, from Gen. John Hewston, Jr.; rock salt, from H. Robinson; six specimens rich gold quartz and amianthus, from Dr. J. M. Hill; *Mus decumanus*, from Wm. Barber; beetles from India, from Prof. Davidson; *Tubicola longipes*, from W. N. Lockington; *Lockingtonia fluvialis*, and *Alloniscus masculosus*, from W. G. W. Harford; four specimens of birds, from W. G. Blunt.

The President spoke of the tarantula, and presented and quoted P. Martin Duncan to correct a misapprehension concerning the insect.

Dr. Blake presented a specimen of infusorial earth obtained from the hills about a quarter of a mile south of the N. E. end of Lake Merced. The deposit was known as the "chalk mine," and a considerable quantity of it had been sent to the Eastern States, as he understood, for the purpose of polishing glass. The deposit has been opened on the side of the ravine. So far as exposed, it appears to form a continuous stratum which has been cut into so as to expose a section of about four feet in thickness, although it probably is much thicker, as the whole hill for some distance seems to be formed of it. It was traced, cropping out at intervals, a distance of 300 yards to the west of where it had been opened, beyond this to the west the surface of the hill was covered by shifted sand. The bed has a dip of about 20°, a little to the E. of S., and appears to be undisturbed. The highest part of the outcroppings is at an elevation

of about 200 feet above the sea, and the bed probably belongs to the Pliocene formations that are found cropping out along the beach to the south of Lake Merced. The deposit has been formed in thin laminæ, and between some of these, ripple marks left by the retreating tide, are perfectly preserved, as in the specimen presented this evening. A microscopical examination of the rock shows that it is made up of silicious particles, evidently of organic origin, probably the remains of diatoms, but no perfect diatom has been discovered. The earth would seem to be composed almost entirely of the remains of the silicious external covering of the diatoms. The more tenacious lamina that have preserved the ripple marks, contain a considerable quantity of clay.

W. N. Lockington read the following paper describing a new species of Colubrine Snake:

Description of a New Genus and Species of Colubrine Snake.

BY W. N. LOCKINGTON.

Bellophis nov. genus.

Body deeper than wide except near the head. Head and fore part of body depressed. Head much wider than the neck with an obtuse snout. Scales smooth, rhombic. Cephalic plates normal. Nasal plates, 2; the nostril near the posterior edge of the anterior plate. A small rectangular breal. A large ante-orbital and two post-orbitals; the lower smaller, partly in a notch between the fourth and fifth labials. Upper labials, 6—7, the centre of the eye over the commissare noiomma, between the third and fourth.

Dorsal rows of scales, 23. Abdominal scutellæ more than 190. Last abdominal scutella entire. Sub-caudal 45, divided. Tail short, about one-seventh the length of the body.

General color—Rings of red, white and black, the abdomen lighter but with traces of the same colors.

Bellophis zonatus. nov. sp.

Rostral plate broad; vertical, almost straight along its anterior edge; temporal shields large. Two pairs of ventral scutellæ, those of the opposite sides closely applied to each other. Nostrils large, infundibuliform. Scales rhombic, increasing in size from back to sides. Snout, top of head and chin black, then a ring of white over the head, continuous with the white of the throat. About 62 black rings from head to end of tail, the first ring just behind the occipital plates. The spaces between the black rings filled alter-

nately with rings of red and white, of which there are 29 of the former color, and 32 of the latter, without counting that on the head.

The difference in number between the red and white rings arises from the fact that the red rings die out upon the hinder part of the tail, which has white rings only.

The red rings in many cases do not cross the back, but are divided by the junction of a pair of black rings. The black rings become wider on the centre of the back, approaching, and in most cases, joining each other in pairs, but always at the expense of the red rings, the white rings being invariably continuous with the white of the abdomen. There are traces of red on parts of the abdomen, and the black rings can generally be partially traced across the abdominal scutellæ.

The specimen in this collection has six upper labials on one side, and seven on the other, the sixth and largest on the left side, being represented by two shorter plates on the right side.

Length of body, 13 inches; of tail, 2 inches.

Abdominal scutellæ, 198; sub-caudal, 45; dorsal rows of scales, 23.

Locality, Northern California. Presented and collected by Paymaster Stanton, U. S. N.

In Baird & Girard's catalogue, p. 153, Blainville's description of *Coluber zonatus*, of which those authors had seen no specimens, is given, and appears to agree in most particulars with the species here described, but the nostrils are hollowed out of the anterior nasal, and the color is different. Blainville describes his specimen as "Reddish white, entirely annulated with deep black, with two half rings of the same color on the head." It is very probably the same species, and for this reason I have preserved his specific name of *zonatus*, but the entire last abdominal scutella, want of carination of dorsal scales, and smaller number of abdominal scutellæ, appear to me to necessitate the formation of a new genus.

W. G. W. Harford read a paper describing a new genus and three new species of Sessile Eyed Crustacea.

Description of a New Genus and three New Species of Sessile Eyed Crustacea.

BY W. G. W. HARFORD.

Lockingtonia. n. g.

Antennæ *not* appendiculate. First three segments of the pleon dorsally carinated, and posteriorly produced to an acute point. Three posterior segments of the pleon *not* furnished with fasciculi of spines on dorsal surface. Eyes, round. Telson, single. Habitat, fresh water.

The above genus agrees with Dexamine and Atylus in its non-appendiculate antennæ. It differs, however, from the former in having the first pair of gnathopoda chelate, three instead of four anterior segments of the pleon dorso-posteriorly produced to a sharp point, and from the latter in the man-

dibles wanting the palpiform appendage. It is removed from Gammarus proper by having no fasciculi of spines on dorsal surface, no appendage to the antennæ, and a single telson. This is a very common Amphipod in nearly all our lakes and small streams, and it is somewhat remarkable that it has until now escaped detection. It occurs in great numbers in Lobos Creek, where our specimens were obtained; also in the streams of Alameda County, and I doubt not, may be found in any of the permanent fresh water ponds or streams along our Coast for a considerable distance north and south of here.

It is with pleasure that I dedicate this genus to Mr. W. N. Lockington, whose ability and industry has accomplished so much towards an orderly arrangement of the Crustacea in our Museum, thus giving us an invaluable cabinet of reference for those who desire to pursue investigations in this interesting department of zoölogy.

Lockingtonia fluvialis. n. s.

Superior and inferior antennæ setose. Superior a little more than half the length of the inferior antennæ, and much longer than their base. Terminal joint of inferior antennæ longer than the preceding; flagella twelve jointed. Flagella of superior antennæ ten jointed. Caudal stylets and legs setose; the latter especially so at the joints. Hand oblong-ovate, palm setose, oblique. Carpus produced posteriorly along the proximal side of the manus.

Hand of first pair of gnathopoda chelate.

Length, $\frac{8}{10}$ inch.

Alloniscus maculosus. n. s.

Cephalon slightly transverse, rounded in front. Outer joint of inner antennæ sub-clavate, with four spines on its summit. Outer antennæ spinulose at the joints. Flagellum multiarticulate, setose at joints. Last joint of outer antennæ about one-third longer than the preceding. First segment of the percion longer than the 2d, 3d, 4th or 5th. The 6th and 7th shortest. The lateral margins of the first two segments of the pleon concealed under the seventh of the percion. Color light brown above, with yellowish brown spots, becoming darker in alcohol.

Length, $\frac{7}{10}$ inch.

This is doubtless identical with some specimens of this genus which Prof. Dana had before him while describing his *Alloniscus perconvexus*, and which he says may probably be another species, Proc. Phil. Acad. 1854, p. 176. It is very near *A. perconvexus*, but may be readily distinguished from it by its light brown color above, with yellowish spots, and its still lighter colored limbs, which are minutely spotted with reddish brown, and its more slender form.

We found our specimens on Angel Island among fern roots, *Woodwardia radicans*, early in March last. A few only obtained.

Asellus Tomalensis. n. s.

Head a little transverse, narrower than the body. Upper antenna not reaching to the extremity of the peduncle of the lower. Flagellum of lower

antennæ longer than its peduncle. Body narrow in front, gradually increasing in width towards the tail.

Peduncle of caudal appendages more than half the length of the terminal filaments.

Length, $\frac{8}{10}$ inch.

This interesting little Isopod was recently obtained by Mr. W. N. Lockington while collecting at Tomales Bay and vicinity, and is, so far as I am aware, the first example of the genus found on this Coast. In that excellent work, "British Sessile Eyed Crustacea" (Bates & Westwood), two species are accredited to N. A., but we find no mention of them by any American author we have applied to, and it is most probable that they were from the eastern part of the continent. We therefore venture to offer this as new. A single specimen only was found, although several casts of the net were made. It would seem, therefore, very uncommon in that locality. We hope, however, that by diligently searching the fresh water ponds and streams along our Coast it may be found in greater numbers, with, possibly, other species of the genus. I hope that collectors will carefully examine our fresh waters for this Crustacean, thereby enhancing the value of our cabinet, and aiding students in acquiring a knowledge of these very interesting little creatures.

W. N Lockington read the following description of a new genus and species of Decapod Crustacean and the male of Phyllodurus abdominalis:

Description of a New Genus and Species of Decapod Crustacean.

BY W. N. LOCKINGTON.

Family PINNOTHERIDÆ.

Tubicola. nov. gen.

Carapace extremely broad; fourth pair of legs much elongated, fifth pair rudimentary.

Habitat, the inside of the tube of an annelid.

Tubicola longipes. nov. sp.

Carapace broad, transverse, more than twice as wide as long; front occupying about one-third of the width of the carapace; antero-lateral margins broadly rounded; postero-lateral somewhat concave, the two meeting at an acute angle in the middle of the side of the body; posterior margin straight.

Branchial regions largely developed, tumid; a long transverse depression in the carapace behind the gastric region; antero-lateral margin bordered by a fringe of setæ.

Third joint of external maxillipeds very small; second joint stout and large.

First pair of legs short, with short carpus and flattened elongated manus having a fringe of setæ on its upper border.

Second and third pairs of legs sub-equal, longer than the first, slender, ending in a sharp claw; the third pair slightly longer than the second.

Fourth pair immensely developed, exceeding in length the width of the carapace, terminating in a stout claw.

Fifth pair shortest, reaching to about the middle of the third joint of the fourth pair; usually held in an elevated position over the posterior portion of the carapace.

Width of carapace a little less than $\frac{1}{4}$ inch; length, $\frac{1}{8}$ inch.

Total length from claw to claw at fourth pair, $\frac{3}{4}$ inch.

Habitat, the sand-constructed tube of an annelid.

I found this curious little crustacean on the tube of an annelid common on the sandy flats left bare at low tide in Tomales Bay. While digging for those sand-excavating lobsters, the *Gebiæ* and *Callianassæ*, I found in abundance the sandy tubes of an annelid about six inches long, with numerous joints or nodes, each of which was surrounded by a circlet of setæ, by whose action the creature propelled itself at pleasure up and down the tube.

Believing the worm to be a new species, I gathered some, and while pulling the tube to pieces, and admiring the rich brownish red tint conspicuous at each node of my new prize, I was surprised to see a long narrow creature move out, as I believed, head first; but a nearer inspection showed me that the motion was sideways, and that the new-comer was no fourteen-legged amphipod or isopod, but a true decapod crustacean.

The short chelæ, extremely lengthened fourth pair of legs, and short, broad body, are so many adaptations to the mode of life of this creature, which finds an ample dwelling-place in the space intervening between the body of the annelid and the inside of the tube; up and down which it moves with its long fourth pair stretched out in such a manner as to to give it the elongated appearance of a *Caprella*.

The width of *Tubicola longipes* from end to end of the fourth pair of legs is eight times greater than its length from front to back.

This is, so far as I am aware, the only instance known of a decapod crustacean becoming the guest or commensal of an annelid, for although the species of the family *Pinnotheridæ* are all commensals, most of them reside between the folds of the mantle of large bivalve mollusks, such as mussels or clams (thus the *Fabia subquadrata* lives within the mantle of *Pachydesma crassitelloides*, a large clam of this Coast), and a few live within the tests of Echini, close to the anal aperture.

It is most probable that this worm and its commensal may occur in many other places besides Tomales Bay, possibly in San Francisco Bay, and I should be much obliged if some of our friends who may go out on a fishing excursion would bring me specimens, in alcohol, of the worm and its tubes, that I may find whether the crab is its constant companion in all localities.

The worm is one which is frequently used for bait.

On April 20th, the females of this interesting little crustacean was loaded with spawn.

Phyllodurus abdominalis. Stimpson.

When Stimpson, in his Crustacean and Echinodermata of the Pacific Shore of N. A., page 71, first described this species, the female only was known to him. This female, like all those belonging to the family *Bopyridæ*, is of comparatively large size, broad and clumsy in appearance, and lives attached to another crustacean.

The crustacean frequented by this commensal is *Gebia pugettensis*, a marine crayfish common on these shores.

About April 24th, I gathered a great number of Gebias in Tomales Bay, and found that most of them, all except the largest specimens, had a female *P. abdominalis* attached to one of the abdominal pairs of feet, to which it clung closely by means of its hooked claws.

A close inspection revealed, beside or near the large female, a small and slender male, a kind of miniature edition of its stout mate.

Never more than a single pair were ever found attached to one Gebia, but the males appeared so regularly to accompany the females, that I believe that in the few cases I did not find them, it was because they had dropped off in handling the specimens.

The males do not live attached to the Gebia, but are free to rove, and their constant presence at this season by the side of the females proves that this is their season of love.

Male. Head semi-circular anteriorly, closely united to the succeeding segment. Third and fourth thoracic segments widest. Body oblong, boat-shaped, tapering slowly from the fourth to the seventh thoracic segment.

Outer antennæ four-jointed; inner very small, reaching about to the middle of the second segment of the outer.

Eyes too small to be distinguished by a Coddington lens.

First abdominal segment a little narrower than last thoracic, but flat; succeeding segments tapering rapidly to the sixth or telson, which is pointed at the end, and is provided on each side with a small lamella, giving the whole telson somewhat the appearance of a spear-head.

The lateral laminæ of the first five abdominal segments round in sections instead of segmental, as in the female, and considerably longer than the width of the segments to which they are attached.

The President referred to a letter on the subject of irrigation sent to him by P. J. Flynn, and explained some of the errors into which he had been led.

The President read a continuation of his paper on Irrigation in India, Egypt and Italy.

The President communicated to the Academy, by the authority of the Superintendent of the Coast Survey, the following memoranda:

DETERMINATION OF THE DIFFERENCE OF LONGITUDE, BY THE ELECTRIC TELEGRAPH, BETWEEN THE U. S. COAST SURVEY STATIONS AT SAN FRANCISCO, CALIFORNIA, AND SEATTLE, WASHINGTON TERRITORY.

DATE.	SEATTLE EAST OF SAN FRANCISCO. Seattle Signals.	San Francisco Signals.	MEAN.	△	DOUBLE TIME OF RETARDATION.	TIME OF RETARDATION.
1871.	*S.*	*S.*	*S.*	*S.*	*S.*	*S.*
Sept. 12....	18.22	18.48	18.35	0.09	0.26	0.13
13....	.22	.51	.37	.07	.29	.15
14....	.25	.74	.49	.05	.49	.24
19....	.31	.62	.47	.03	.31	.15
21 .	.33	.76	.54	.10	.43	.21
28....	.30	.57	.44	.00	.27	.14
30....	.24	.61	.42	.02	.37	.18
Oct. 2....	.30	.62	.46	.02	.32	.16
8....	.25	.57	.41	.03	.32	.16
9....	.27	.59	43	.01	.32	.16
12....	.24	.56	40	.04	.32	.16
14....	.38	.70	.54	.10	.32	.16
15....	.28	.62	.45	.01	.34	.17
	18.276	18.612	18.44	....	0.34	0.17

			S.	*S.*
Correction for personal equation			— 0.02	± 0.01
			S.	*U.*
Resulting difference of Longitude			18.42	+ 0.02
	H.	*M.*	*S.*	*S.*
Telegraphic Longitude of San Francisco station	8	09	38.35	± 0.08
Hence Longitude of Seattle	8	09	19.93	± 0.08
Or in Arc	122°	19′	58.59	± 1.2′

Observer at San Francisco, George Davidson.
Observer at Seattle, S. R. Throckmorton, Jr.
Communicated to the California Academy of Sciences by authority of the U. S. Coast Survey, April 17th, 1876.

REGULAR MEETING, MAY 15th, 1876.

President in the Chair.

Twenty-one members present.

The following new members were elected:

H. W. Reese, Albert Arents, C. A. Luckhardt, Emlen Painter, Louis Falkenau.

Donations to the Museum: From Lieut. Murray S. Day, U. S. Navy, the following articles from the "Ainos" of the Islands of Yesso, Japan: one bow and three arrows, one of which is prepared with poison; one piece of Aino cloth made of the inner bark of the Mikapp, a kind of ash; also sword used in making the cloth; one fisherman's knife; one pair Aino socks, made of bark; one pair of winter shoes, made of salmon skin; one "Passu," or moustache lifter, used in the drinking ceremony for lifting the moustache; one hat, made of bark twine; one musical instrument, called the "Ka," played with four strings and two bridges. From C. D. Gibbes, thirty specimens of silver, copper, native copper, cinnabar, pyrites and quartz crystals. From A. H. Nahor, specimens of silicified wood and gold-bearing cement from Iowa Hill, Placer Co., Cal. From G. A. Treadwell, thirty-three specimens of ore. From W. Collis, a specimen of oak with a piece of some kind of mineral in the centre. From Henry Edwards, specimens of marmoratus, ostracion, Pegasus and Grapsus. From W. G. Blunt, specimens of Segnathus, and eggs of some of the Rhinotalidæ. From Geo. Davidson, Coleoptera from Egypt.

Mr. C. D. Gibbes read some remarks on the minerals presented at the last meeting.

Professor George Davidson read a continuation of his paper on Irrigation in India, Egypt and Italy.

Regular Meeting, June 5th, 1876.

President in the Chair.

Thirty-seven members present.

The following new members were elected: Rudolph Thormann, L. L. Hawkins, Walter W. Dannenberg, Edward N. Moor, and Robert Chalmers Lord.

Donations to the Museum: From E. S. Holden, lignite from coal mine, Alameda County. Bog iron ore from Calaveras County; portion of tarantula nest. From Thomas Holmes, red hematite from Nevada. From C. D. Gibbes, anthracite coal from Pennsylvania. From A. B. Stout, trachite from Sonoma County. D. Buck presented silver ore from Lee District, Inyo County, Cal. From Henry T. Compton, fifty eggs. From W. N. Lockington, four specimens of fish, and eggs of the spotted shark. From T. J. Butler, Arizona parasitic plant. Bamboo plant from Professor Davidson. From James Lick, fossil tooth found in digging road to new observatory on Mt Hamilton.

Henry Edwards presented a paper on Pacific Coast Lepidoptera, No. 17.

Pacific Coast Lepidoptera—No. 17. On the Transformations of Colias (Meganostoma Reak) Eurydice, Bdv.

BY HENRY EDWARDS.

Some five years since I observed that the females of this rare and beautiful butterfly were in the habit of hovering over the singular Leguminose plant, *Amorpha californica*, Torrey, and upon one occasion, I thought I detected one in the act of laying her eggs, but the most careful search for such demonstration, though followed over the whole bush by the aid of a pocket lens, failed to establish the fact, and I believed that I had been deceived, and that the food-plant of the species must be sought for elsewhere. Two years ago, however, the same circumstances re-occurred, and in this instance, I noticed six different females alight upon bushes of *Amorpha*, and proceed as insects usually do in the process of the deposition of eggs. I again searched these bushes, and again without success, and I was led to the somewhat wild conclusion that the eggs are deposited at random, and allowed to drop to the ground at the base of the plant; the instinct of the parent trusting to the power of the

young larva to find its proper food, when, after its winter sleep, the plant should put forth its spring adornment. The *Amorpha* is particularly local, and not easy of cultivation, so I had no means of following up my observations, but by travelling some miles to the spots in which the plant happens to grow, and these being at a distance of from 30 to 100 miles from San Francisco, the opportunities afforded me were but few. Every season, however, I followed up the small trail which I had struck, and this year, I was fortunate enough to have my hopes of the discovery of the earlier stages of this charming species crowned with complete success, and at White Sulphur Springs, Napa Co., on the 7th of May last, I had the extreme gratification of seeing the caterpillar for the first time. Upon some plants of *Amorpha*, which very specimens I had carefully searched for five years, I found 19 examples in different stages of growth; and have since had the satisfaction of seeing all transform to the chrysalis state; and some few reach the imago. The species appears to be as delicate in physical habit as its colors are beautiful, and it feeds exclusively upon the plant on which it was originally found. I tried the caterpillars with *Psoralea*, *Astragalus* and *Hosackia*, among Californian plants, and with *Cassia* and *Swainsonia* among exotics, but it would eat none of them, and no matter how dry the leaves of its own food might be, it devoured them readily, and appeared to thrive. The result of my first experiment with this species has been as follows:

The full grown larvæ began to change to the chrysalis on the 9th of May, and by the 14th, all had gone into that stage; the first imago emerging on the 28th. I should add that in addition to the 19 nearly full grown larvæ which I brought successfully to the chrysalis state, I found four younger ones, two of which had scarcely passed the second moult, the other two being a little older. The whole of these, however, died soon after my reaching home. I have raised out of my 19 caterpillars, seven males and four females, seven of the remainder dying in the chrysalis stage from some singular disease. Without any mark to proclaim any kind of sickness, about the third or fourth day after the transformation, a livid spot appeared upon the base of the abdominal region, and in two days more this was extended to the whole surface. By the end of the 10th day, the chrysalis had assumed a blackish hue, and withered completely away, leaving only the dry husk to tell the tale. No parasite has emerged from these specimens, nor does it appear likely that any such event may happen, as the remaining specimen was infested by a large Dipterous insect, common to many species of Lepidoptera which has already produced its imago. I regret that a knowledge of the egg has so far escaped me, but I hope to be able to furnish this fact before the close of the year. Mr. R. H. Stretch was kind enough to make a figure of the larva and chrysalis, which will be published in Mr. W. H. Edwards exquisite work on the Butterflies of North America. In the meantime I offer the following description:

Larva. General color pale yellowish green. Head rather small, bluish green, with a few short hairs in front. Body entirely covered with minute black irrorations, with a faint indication of a pale dorsal stripe. There is a very distinct white lateral stripe, enclosing the spiracles, which are bluish white, and are surrounded by a yellow dash. Above the spiracles are ten well-

defined black spots, around which the irrorations are thicker, forming a black cloud. Under side entirely whitish green.

Length, 1.45 inch.

Food plant, *Amorpha californica*, Torr.

Chrysalis. Entirely pale yellowish green, surface slightly wrinkled, the dorsal region covered with white specks. Beak very sharp, and broadly keeled. Thoracic protuberance a long, acutely-edged ridge. The yellow dorsal line is visible as in the larva. When the imago is about to emerge, the wing cases assume a darker shade, until the pattern and color of the primaries of the perfect insect may be gradually but distinctly seen. After emergence, the chrysalis case is pure white, and very transparent and glossy.

Length, 0.95 inch.

Width across wing cases, 0.28 inch.

First imago appeared May 28th, the last on June 5th, the average time in chrysalis state being 19 days.

Professor Davidson read a continuation of his papers on "Irrigation in India, Egypt and Italy."

Mr. F. Gruber read the second of his course of lectures on ornithology, illustrating his remarks with specimens prepared by himself. This lecture treated particularly of "Birds of Migration and Song."

REGULAR MEETING, JUNE 19TH, 1876.

Vice-President Hyde in the chair.

Fourteen members present.

Donations to the Museum comprised a large gopher snake, from W. G. Blunt.

Mr. Dameron described a recent visit to Mt. Tamalpais, in Marin County, which caused some discussion concerning the peculiar mark on the side of the mountain.

REGULAR MEETING, JULY 17, 1876.

Vice-President Edwards in the Chair.

Twenty-five members present.

Donations to the Museum: From M. D. Hyde, vial of mud from soundings made from the "Tuscarora." From Henry Edwards, *Hyla*, sp., *Eutænia sirtalis*, *Allorchestes plumulosus*.

In the donations to the library was a volume of the "Botany of California," to which the Vice-President called particular attention. It is now published through the munificence of certain of our citizens, the State Geological Survey having been discontinued, and no money having been appropriated to publish this work. As Judge S. C. Hastings had been mainly instrumental in obtaining the money by means of which the publication of the work was insured, a vote of thanks to that gentleman was passed by the Academy.

W. N. Lockington submitted the following:

Check List of the Decapod and Tetradecapod Crustacea of the West Coast of North America.

BY W. N. LOCKINGTON.

The appended list contains 231 species, collected from the writings of Dana, Stimpson, S. I. Smith and Hale Streets, with the addition of above forty recently described by Mr. W. G. W. Harford and myself.

It is not unlikely that other Panaman and Arctic forms may have been described by American and European naturalists, whose works are not accessible to me; but I have worked in the belief that a check list was wanted, and that the only way to have one was to avail myself of the materials at hand—in the hope that those who have better materials, or more of them, will either be so good as to send me their additions or corrections, or will publish a fuller and better list.

Even if this list should prove complete, or nearly so, as regards species hitherto described, it probably does not contain the half of those actually existing on the long line of coast stretching from Panama to the Arctic Ocean.

Only the more conspicuous species from the coast north of Monterey have hitherto been described, while south of that old city, and extending almost to Panama, lies a vast region which, so far as I am aware, has scarcely been searched at all for Crustacea, though its birds, reptiles, fishes and mollusks have been pretty thoroughly studied.

Numerous Decapoda from Panama and Nicaragua have recently been described by S. I. Smith, and others by Hale Streets, yet the series of new forms given by them must be considered only as a sample of the riches of that region.

Even in and around San Francisco Bay we have found several new species of Tetradecapoda, and probably a systematic dredging would bring to light many more.

Very little dredging has been done along the coast, and that little has been confined to comparatively shallow depths.

The fresh-water streams and lakes of California, as well as those of Mexico, have yet to yield their quota of species for some future check list.

The Entomostraca and Cirripedia as yet described are very few, and these departments offer a large and inviting field to the naturalist.

It is my intention, from time time, to furnish the Academy with additional notes of the species already known, as well as descriptions of such new species as may be sent to us.

Some few of the new species included in this list may, without doubt, prove to have been already described, but I feel assured that this will only be the case with Alaska forms, some of which may probably range throughout the Arctic Seas, inhabiting both North Pacific and North Atlantic.

The names of the naturalists who have described species are given in full throughout this list, with the exception of Stimpson, which is abbreviated to St.

The species at present in the collection of the Academy are denoted thus *.

DECAPODA BRACHYURA MAIOIDEA.

Chionœcetes Behringianus. St	In deep water.	Behring's Sts.
Hyas latifrons. St		Behring's Sea.
Hyas coarctatus. Leach		Behring's Sts.
Hyas lyratus. Dana	In deep water.	Oregon.
Herbstia parvifrons. Randall		"Western America."
*Libinia? verrucosa. Lockington		Mazatlan.
*Loxorhynchus grandis. St		Santa Barbara.
Loxorhynchus crispatus. St		San Miguel.
Omalacantha hirsuta. Hale Streets		Panama.
*Inachus tuberculatus. Lockington		
*Pisoides? tumidus. Lockington		San Diego.
*Microrhynchus ? Hemphillii		San Diego.
Libinia affinis? Randall	Variety of *L. canaliculata.*	"Upr. Cala."
Chorilia longipes. Dana		Oregon.
*Scyra acutifrons. Dana.		Puget Sd., San Diego.
Othonia picteti. De Saussure		Mazatlan.
Mithraculus coronatus. St		Panama.
Mithrax armatus. De Saussure		Mazatlan.
Oregonia gracilis. Dana		Puget Sd.
Oregonia hirta. Dana		Puget Sd.
*Pugettia gracilis. Dana		Puget Sd.

REGULAR MEETING, JULY 17TH, 1876.

Vice-President Edwards in the Chair.

Twenty-five members present.

Donations to the Museum: From M. D. Hyde, vial of mud from soundings made from the "Tuscarora." From Henry Edwards, *Hyla*, sp., *Eutœnia sirtalis*, *Allorchestes plumulosus*.

In the donations to the library was a volume of the "Botany of California," to which the Vice-President called particular attention. It is now published through the munificence of certain of our citizens, the State Geological Survey having been discontinued, and no money having been appropriated to publish this work. As Judge S. C. Hastings had been mainly instrumental in obtaining money by means of which the publication of the work was insured, a vote of thanks to that gentleman was passed by the Academy.

W. N. Lockington submitted the following:

Remarks on the Crustacea of the Pacific Coast of North America, including a Catalogue of the Species in the Museum of the California Academy of Sciences, San Francisco.

BY W. N. LOCKINGTON.

The collection of Crustacea belonging to this institution is tolerably complete as regards the species inhabiting the Pacific Coast from Cape St. Lucas northwards, and also includes many forms from Oceania and the Indo-Pacific, but is deficient in Atlantic, African and Australian forms.

The Pacific Island specimens are, for the most part, the gift of Andrew Garrett; while those from this coast, to which these remarks are confined, have been presented chiefly by W. J. Fisher, Hy. Hemphill, Hy. Edwards and W. G. W. Harford.

MAIOIDEA.

The want of a good scientific library on this coast is severely felt by any one who attempts to describe a new species, and I have never felt it more acutely than when endeavoring to marshal in their proper places the numerous novelties belonging to this group of Crustacea that have been brought from the Gulf of California by Mr. W. J. Fisher.

Without type specimens of any of the European or Atlantic coast genera, with abridged descriptions of many genera, and nothing but incidental allusions to others, coupled by a reference to works inacessible to me, the task of identification is a hard one, and I therefore crave indulgence if, in one or two cases, a new genus has been founded where an old one would have fitted, or a species has been described as new because I have not seen the description.

The total number of species of Maioid crabs now known upon this coast, including the *Parthenopidæ*, two or three forms that may possibly be synonymous, and one, the locality of which is doubtful, is thirty-nine, of which nineteen only are included in Stimpson's "Crustacea and Echinodermata of the Pacific Coast N. A.," published in 1857.

Eleven new species are described in this paper.

Family MAIIDÆ.

Sub-fam. INACHINÆ.

1. *Microrhynchus* (*Inachus*) *tuberculatus*. Lockington. Proc. Cal. Acad. Sci. Feb. 7, 1876.

The rostrum in this species is entire, whereas in *Inachus scorpio* it is emarginate and shorter; moreover, the proportionate lengths of the second pair and the carapax are rather those of *Microrhynchus* than of *Inachus* (as given by Dana.)

The present species does not appear to be very abundant, as Mr. Fisher obtained only two specimens on the West coast of Lower California.

No. 1. Two specimens, male and female, dried. San Diego. Hy. Hemphill.

2. *Chionœcetes Behringianus*. Stimpson. Crust. and Echinodermata Pac. Shores N. A., p. 8. At 80 fathoms, off Cape Romanoff.

PISINÆ.

3. *Hyas latifrons*. Stimpson. Prod. Animal. Evert. Ocean, Pac. Septen., 24.

Like *H. coarctatus* but with the body shorter, wider in front, less tuberculated above, and with obtuse angles; the rostrum shorter and less acute, and the fissure of the superior margin of the orbit closed.

Common in Behring's Straits.

The Cal. Acad. Sci. possesses a single specimen of this species.

No. 1*a*. Alaska, dried. W. J. Fisher.

4. *H. lyratus*. Dana. Crust. U. S. Ex. Exp. 1, p. 86, plate 1, fig. 1. Stimpson. Crust. and Echi. Pac. Shores N. A., 10.

Deep water on the coast of Oregon.

5. *H. coarctatus.* Leach. Malac. Pod. Brit. pl. XXI, b. Milne Edwds. Hist. Nat. des Crust. 1, 312. Brandt. Sibirische Reise, 1, 79. Stimpson. Crust. and Echi. Pac. Shores N. A., 10.

Behring's Straits.

Herbstia parvifrons. Randall. Jour. Acad. Nat. Sci. Phil., VIII, 109 Gibbes, Proc. Amer. Assoc. for Advancement Sci., 170. Stimpson. C. & E. P. C. N. A.

Dr. Randall's description of this species is very imperfect. Stimpson and Gibbes give no description, but simply refer to the specimen in the Philadelphia Cabinet. "Western America, *Nuttall.*"

It is not improbable that one of the species described further on may be identical with this.

7. *Platypes edentata.* Lockington. Proc. Cal. Acad. Sci., March 20, 1876.

La Paz, 3 fms. Port Escondido, Mulege Bay. Mazatlan.

By an error in my original description, the "manus" of the first pair of limbs was stated to be alveolate on its upper edge. It is the merus that is alveolate. The extremely broad depressed appearance of the four hinder pairs is mainly due to the abundant tomentosity of their anterior and posterior margins, yet the limbs themselves are considerably flattened.

The first pair of limbs, in alcoholic specimens, are of a bright, shining carmine tint. The shape of the carapax is that of the *Pisinæ*, but the bifid rostrum renders its position doubtful.

No. 12. Female and two young specimens, dried. Mazatlan. Hy. Edwards.

No. 18. Male and female, in spirits. Gulf of California. Fisher and Lockington.

8. *Loxorhynchus grandis.* Stimpson. Crust. and Echi. Pac. S. N. A., 12.

Stimpson says of this species, "taken off the coast of California, near San Francisco." I have never heard of this crab in this locality, and it is never brought to market.

The Museum of the Cal. Acad. Sci. possesses two dried specimens, one, a male, from Santa Barbara, the other, a female, from Santa Catalina Island.

No. 10. Male. Santa Barbara. Mr. Lorquin.

No. 11. Female. Santa Catalina Island.

9. *Loxorhynchus crispatus.* Stimpson. Crust. and Echino. P. S. N. A., 13.

I have not seen this species.

10. *Homalacantha hirsuta.* Hale Streets. Proc. Acad. Nat. Sci. Phil., 1871, 238.

Panama.

Ala. nov. gen.

Rostrum bifid to base, deflected downwards; fixed joint of outer antennæ broad, the outer apex continued into a long spine in the same plane with the

rostrum. Antero-lateral teeth triangular, the two posterior forming a broad wing-like expansion.

The proper place of this genus is evidently among the *Pisinæ*, and its affinities with *Rhodia* (Bell) and *Herbstia* (Edwards), but the form of the carapax and of the first joint of outer antennæ does not agree with either, while from the former it differs in having the first pair slightly longer than the second; and from the latter (at least from *H. cordyliata*,) in the presence of a pre-orbital spine.

11. *Ala spinosa.* nov. sp.

Carapax with broad lateral expansions rendering it wider than long. Rostrum, bifid, shorter than the base of the external antennæ. Movable basal points of antennæ short. A long spine, exterior to the antennal base, projecting nearly as far forward as the rostrum. An acute spine on the upper anterior margin of orbit, and a much smaller post-orbital. Antero-lateral spines three, beside the post orbital; the second and third forming the wing-like expansions of the carapax. Of these, the second is the largest, and the third is short anteriorly, but has a long thin posterior border. Upper surface of rostrum with two rows of hairs. Ten tufts of hairs on the gastric and intestinal regions, corresponding to the tubercles of those surfaces. Postero-lateral and posterior margins of carapax with a row of tufts of hairs. Chelipeds of equal proportions in both sexes, very slightly longer than the second pair; arm tubercular above, carpus ditto, manus smooth and slender; dactyli in contact, in female, gaping in male; the parts in contact serrated on inner edge, extremities pointed. Hinder pairs beset with spines, each spine terminating in a bunch of hairs. Abdomen of female surrounded by a fringe of hairs.

Localities: La Paz, San José Island, Port Escondido, Gulf of California.

	♂ M. M.	♀ M. M.
Length of carapax	22	24
Width of " across lateral expansions.	23	26

Almost all the specimens are female, their abdomens laden with ova. They were taken in August or September.

No. 14. Male and female, in spirits. Fisher and Lockington.

12. *Pisoides? celatus.* nov. sp.

Carapax triangular ovate; branchial, cardiac and stomachal regions prominent, tumid; rostrum short, bifid to base; fossettes and inner antennæ small; fixed joint of external antennæ very broad, with a long spine as its outer exterior border, this spine forming part of the orbit. A spine upon the upper surface of the carapax slightly behind that of the fixed antennal joint, yet somewhat in advance of the eye, this (pre-orbital) spine divided by a triangular notch from the post-orbital, behind which, on the antero-lateral border, are two smaller spines. On each branchial region a group of two or three conspicuous spines, and some smaller ones on the posterior margins. The ciliate movable joints of outer antennæ as long as rostrum, flagella about

three times as long as rostrum. Upper surface of carapax hirsute, especially upon the rostrum. Hinder part of sternum and abdomen tomentose. Chelipeds almost as long as second pair, without hairs; merus with about four teeth on its superior margin; carpus slightly tubercular; manus perfectly smooth. The movable finger occasionally has a tubercle between the base and the tip. Movable and fixed fingers serrated for half their length and interlocking on their outer margins. Hinder feet hirsute, short, a spine on the upper surface of the fourth joint of second and third pairs.

Color, reddish-brown above, the hands and under parts white, marbled with bright red, the latter predominating on the upper surface of the chelipeds.

Localities: La Paz, Mulege Bay, Port Escondido, San José Island, all in the Gulf of California.

It is found under stones at low tide, and was also brought up at La Paz by the dredge.

The females have no tubercle on the inside of the dactyli, and the spines upon the branchial region are not prominent. They were with ova when collected, in the month of August.

	♂ M. M.	♀ M. M.
Length of carapax	20	13
Width of carapax	17	12

The females are rather less elongated than the males. The carapax in both sexes is exceedingly overgrown with corallines, sponges, sertularia, etc.

No. 16. Two males and two females, in spirits. Fisher and Lockington.

This little crab evidently belongs to the *Pisinæ*, but does not fit well into any of the genera given by Dana. The characters are nearest those of *Pisoides* and *Herbstia*, but from the former it differs in the presence of a preorbital spine, and from the latter in the great width of the fixed joint of the external antennæ, as well as in the small size of the chelipeds.

I think it not unlikely that this form is the *Herbstia parvifrons* of Dr. Randall, (Proc. Phil. Acad. Sci., 1869, p. 107), but his description is so short that it is impossible to be certain; so far as it goes, however, the characters given agree.

13. *Pisoides? tumidus*. Lockington, Proc. Cal. Acad. Sci., Feb. 6, 1876.

I have received specimens of this species from San Bartolomé Bay and Magdalena Bay, all of them smaller than the type in the possession of the Academy. Those from Magdalena Bay were dredged in three fathoms.

The first article of the external antennæ is acute on its outer angle, but can scarcely be called a spine, the second and third are long, ciliated, and cylindrical, in the last character differing from the generic description given by Dana.

No. 6. Female. San Diego, between tides. Hy. Hemphill.

LIBININÆ.

Libinia canaliculata? Say.

14. *Libinia affinis?* Randall. Jour. Acad. Nat. Sci., Phil., VIII, 107. Gibbes, Proc. Am. Asso., 1850, p. 170. Stimpson, Crust. and Echi. Pac. S. N. A., 14. Hale Streets, Proc. Acad. Nat. Sci., Phil., 1870 p. 170.

I have lately found among the crustacea collected by Mr. Fisher, two fine specimens of a *Libinia*, from San Bartolomé Bay, Lower California. They are much larger than the specimens described by Randall, and without tubercles interspersed among the spines. The species consist of a central dorsal row of eight, the first of which is the central one of a transverse row of three on the anterior portion of the gastric region. Two of the dorsal row belong to the cardiac, and one to the intestinal region. Nearly in a direct transverse line with the first cardiac spine are two others on each branchial region; and in a direct transverse line with the second cardiac spine are a blunt spine or tubercle and two spines on each branchial region, thus forming a row of seven. Right and left of the intestinal spine is a small one on the posterior part of each branchial region. Rostrum but slightly cleft, setose at extremity and on upper surface, not at all deflected; ante-orbital spine much smaller than post-orbital, which is broad and curved posteriorly; two spines on each antero-lateral margin, and two smaller ones near together on each hepatic region, in a line between the anterior antero-lateral spine and the transverse row on the stomach. The outermost spine of the transverse row of seven is the largest. The feet are without spines or tubercles. The largest specimen measures as follows:

	M. M.
Length of carapax	52
Width of carapax, without measuring the spines	39

Both the specimens are female.

I have never seen a specimen of *L. canaliculata*, nor Randall's specimen of *L. affinis*, but it is unusual to find an Atlantic species existing unaltered at such a point as San Bartolomé Bay, remote both from the Isthmus of Panama and from Behring's Straits, and for this reason I should not be surprised if it should prove distinct, in which case I propose for it the specific name *setosa*, on account of its setose rostrum.

MICIPPINÆ.

15. *Micippa ovata.* nov. sp.

Carapax ovate, truncate in front, front narrower than in *M. hirtipes*, Dana. Post-orbital spine in the same line with pre-orbital, the two separated by a triangular notch. Antero-lateral margin with five sharp spines directed forwards, excluding the post-orbital, the lateral edge of which is elongated. Upper surface of carapax arched transversely, almost semicircular in section; tubercles numerous, but without spines. Chelipeds short, smooth, fingers serrate at tip. Hairs sparsely scattered on hinder feet and carapax, rostrum pilose, especially round the margin.

Localities: Port Escondido, Mulege Bay, Los Angeles Bay, San José Island, La Paz.

	♂ M. M.	♀ M. M.
Length of carapax	21	19
Width of carapax at third antero-lateral spine	18	16
Length of first pair	19	12.5

Var. *lævis.*

Rostrum, orbits, antero-lateral spines, and limbs exactly as previously described, but the carapax more broadly ovate, and without tubercles, and the chelipeds much larger in the male.

	M. M.
Length of carapax	21
Greatest width at fourth antero lateral spine	19.5
Length of first pair	30

This is a well-marked species, and exceedingly elegant in appearance. The male which I have described as var. *lævis* is the largest among several from various localities. The smooth carapax and large chelipeds render it conspicuous among the others, yet I am inclined to believe these characters only varietal, and not improbably only individual.

No. 20. Male and female, in spirits. Gulf of California. Fisher and Lockington.

CHORININÆ.

16. *Chorilia longipes.* Dana. U. S. Ex. Exp., 1, p. 81, pl. 1, fig. 5. Stimpson. Crust. and Echi. Pac. S. N. A., 14.

17. *Scyra acutifrons.* Dana. U. S. Ex. Exp ., vol. I, p. 95, pl. 11, f. 2 Stimpson. Crust. and Echi. P. S. N. A., 15.

No. 7. A single dried specimen from San Diego, by Henry Hemphill, caught between tides.

Chorilibinia. nov. gen.

Rostrum long, broad, and emarginate at tip as in *Libinia*, but the eyes concealed beneath it as in *Chorinus* and its allies. Pre- and post-orbital spines acute, separated above and below by an acute fissure, and together constituting the orbit. Carapax triangular.

18. *Chorilibinia angustus.* nov. sp.

Carapax triangular, narrowing gradually to the region of the eyes, the orbits of which are salient. Rostrum long, emarginate at tip, the bifurcation divergent, extending only one-third the length of rostrum. Fixed joint of external antennæ terminating outwardly in a long spine which precedes the pre-orbital when looked at from above. Pre-orbital spine large, acute, separated from the acute post-orbital by an acute fissure, both above and below. Antero-lateral margin with three spines beside the post-orbital, the largest spine at the angle between antero- and postero-lateral margins. Tubercles of carapax prominent, each culminating in a single spine. A tubercle with spine on the posterior angle. Movable basal joints of outer antennæ setose, slender, cylindrical. Chelipeds slender, about the same length as second pair; merus (arm) with four tubercles above; manus smooth, slender; dactyli small, slender, in contact most of their length, serrate on inner border. Four hinder pairs rounded, slender, second much the largest; claws sharp.

The whole of the upper and under surface, except the inner side of the hand and upper surface of the rostrum, tomentose, with longer hairs at intervals, and a row of the latter on each side of the rostrum.

Locality, Gulf of California.

	♂ M. M.	♀ M. M.
Length of carapax	20	23
Greatest width of carapax	12	15

Out of the three specimens in my possession the female is the largest, but has the rostrum shorter than the males.

19. *Othonia picteti.* De Saussure, Revue et Magasin de Zoologie, V, 357, pl. XIII. f. 2.

MITHRACIDÆ.

20. *Mithrax armatus?* De Saussure, Revue et Magasin de Zoologie, V, 335, pl. XIII, f. 1.

Either this species or the succeeding is most probably the *M. armatus* of De Saussure, but for the reasons given more fully under the next species, I cannot be certain of its identity, and therefore subjoin a description.

Rostrum bifid, the horns not lamellate; carapax broadly pyriform; verrucose throughout its upper surface, the verrucæ becoming spinose on the posterior portion of the carapace. Exterior side of the fixed joint of outer antennæ with a long spine at the extremity, followed by a shorter. A short pre-orbital spine, separated by a deep notch from the post-orbital. Margin of carapace with five large spines besides the post-orbital, four upon the antero-lateral, the fifth upon the postero-lateral margin. A second row of smaller spines upon the sub-branchial region. First pair of limbs short; dactyli not tapering, obtuse and imperfectly spoon-shaped at end; propodus oblong, more than twice as long as wide, smooth; carpus and merus spinose above, but without the smaller tubercles found on the carapax. Four hinder pairs slender, cylindrical; merus and carpus spinose above like those of first pair; propodus slightly hirsute, smooth; terminal joint (dactylus, tarsus) hirsute, ending in a recurved claw of an orange color. Abdomen six-jointed in the female. The whole of the upper surface of carapax and limbs, between the spines and tubercles, is finely punctate; and the whole of the lower surfaces tomentose.

A single female from Mazatlan, presented by Hy. Edwards, is the only specimen I have seen of the species.

	M. M.
Length of carapax to tip of rostrum	32
Width of carapax from tip to tip of fourth marginal spine	30
Length of first pair	28
Length of second pair	32

Color of the specimen a light flesh tint.

No. 3. Female, dry. Mazatlan. Hy. Edwards.

21. *Mithrax areolatus.* nov. sp.

The only species of *Mithracinæ* that have been, to my knowledge, previously described from this coast are the *Mithrax armatus* of De Saussure, and the *Mithraculus coronatus* of White and Stimpson.

De Saussure's description is not accessible to me, and the only mention I have of the species is in Stimpson's Crust. and Echi. Pac. Shores N. A., where the reference is given, and the locality (Mazatlan) of the specimen in the Mus. Phil. Acad.

Mithraculus coronatus finds a place in the "Catalogue of Crustacea from the Isthmus of Panama, collected by J. A. McNeil," by T. Hale Streets, but that author does not state from which side of the Isthmus his specimens came. I find the same species in S. I. Smith's "Brazilian Crustacea," from which I infer that it is not unlikely McNeil's specimens were from Aspinwall.

Dana says of *Mithrax:* "*Articulus antennarum externorum 1mus apice externo, duabus spinis longis armatus,*" but the antennal spines in *M. dichotomus* of the Mediterranean are very short, as they are in the present form. *Mithraculus,* however, is stated by Dana to be without long antennal spines.

As the antennal spines in this species are evident, but are rather teeth or lobes than spines, I assume that I have before me either De Saussure's *Mithrax armatus* or a new species—most probably the latter, more especially as, besides the doubtful locality, the proportions of the carapax given by S. I. Smith for his specimens of *Mithraculus coronatus,* do not agree with the present species, which has the length and breadth more nearly equal. I subjoin a short description:

Carapax almost orbicular, slightly wider than long; front four-lobed, the pre-orbital teeth projecting almost level with the two central lobes which constitute the rostrum. Fixed joint of outer antennæ with two obtuse teeth on its outer apex. Antero-lateral margin with five teeth, including the post-orbital, third tooth largest.

Regions of carapax very distinct and subdivided into areolets answering to those of the Xanthinæ and Chlorodinæ; areolets with punctate surface, without spines or teeth, and almost free from hair. Merus and carpus of first pair with spinose tubercles, hand smooth, cristate above. Those of female similar but smaller. Posterior feet beset with spines on their exposed surfaces, and densely pilose.

	♂ M. M.	♀ M. M.
Length of carapax	16	13
Breadth of ditto	18.5	15

Localities—Port Escondido, San José Island, Gulf of California. Found at low tide under stones and coral. Color, in spirits, light red.

If this species should prove to be new, I propose to name it *Mithrax areolatus.* The females, when collected in the month of August, were loaded with ova.

No. 13. Male and female, in spirits. Gulf of California. Fisher and Lockington.

Fisheria. nov. ger.

Carapax orbiculo-ovate, depressed, with short preorbital and post-orbital spines. First joint of outer antennæ wide, terminating outwardly in a long spine, which is followed by three others, which form the inferior margin of the orbit. Chelipeds of male, 2½ times the length of carapax; those of female shorter than the second pair. Fingers serrate, obtuse and imperfectly spoon-shaped at tip.

This genus is evidently nearly allied to *Mithrax*, but the great length of the first and second pairs of limbs in the male, as compared with the carapax, and the row of teeth on the external margin of the fixed antennal joint, appear to necessitate its separation. The general aspect of the single species here described is totally different from that of *M. dichotomus* or *M. asper*, which are the only two species I have seen figured.

22. *Fisheria depressa.*

Male—Carapax depressed, widely pyriform, the regions marked by slight elevations granulated on the summit, the margins and spaces between the elevations somewhat tomentose. Rostrum bifid, short, reaching to the centre of the terminal joint at base of outer antennæ. A long spine at the external angle of the fixed joint of outer antennæ, succeeded by three smaller spines. Movable base of outer antennæ as long as flagellum, second joint largest, second and third joints slender, cylindrical.

Upper surface of carapax almost spineless, margins and orbits spinous. Orbit with two teeth above and four acute spines below, the two anterior of which belong to the fixed joint of antennæ. A row of teeth on the hepatic region, continued outwards from the maxillipeds.

Chelipeds of male enormously long, ischium produced into an acute spine on its anterior border; meros rounded, as long as post-rostral portion of carapax, beset with acute spines on its upper surface; carpus short, tuberculated; manus slightly longer than entire length of carapax (measuring to the end of the fixed finger); entirely smooth, compressed and broad, with rounded upper and lower edges; dactyli gaping, their obtuse ends imperfectly spoon-shaped and serrated, movable finger with a tubercle at half its length on inner border. Second pair 1½ times as long as carapax, meros similar to that of first pair, with a row of about ten long spines on its upper surface, and a single spine on the distal extremity of its lower; carpus with a few spines; propodus very slender, entirely unarmed. Three hinder pairs similar to second pair, all with a single spine at distal end of underside of meros. Four hinder pairs sparsely hirsute above.

	M. M.
Length of carapax	27
Width of ditto	24
Length of first pair	68
Length of manus of ditto	33
Length of second pair	42
Length of fifth pair	33

These measurements are taken from the largest of six male specimens from Port Escondido, Lower California.

Female—Carapax as in male. Chelipeds shorter than second pair, fingers less widely gaping, no tooth on movable finger. In other respects as in male.

	M. M.
Length of carapax.	21
Width of ditto	18
Length of first pair	24
Length of second pair	29

These dimensions are taken from the largest of eight specimens from Port Escondido and San José Island, Gulf of California.

Color, in spirits, bright red, the smooth manus, undersides of legs, and buccal apparatus especially bright.

No. 21. Male and female, in spirits. Fisher and Lockington.

23. *Mithraculus triangulatus.* nov. sp.

Carapax as broad as long; in form an acute isosceles triangle truncated in front; regions prominent, antero-lateral margin with three lobes. Rostrum very short, bifid, scarcely projecting beyond the line of the fixed joint of the outer antennæ, which terminates in a blunt tooth, followed by a second tooth or rather lobe, forming part of the lower margin of the orbit. Outer antennæ ciliate, movable basal joints cylindrical, short; second joint considerably stouter than the third. Lower margin of orbit formed by the teeth belonging to the fixed antennal joint, followed by a small tooth intervening between them and the post-orbital. Pre-orbital tooth scarcely evident, forming the obtuse termination of the elevated orbital region.

Chelipeds stout, longer than the second pair by almost the length of the hand, arm tubercular above, hand and carpus smooth, the former broad and heavy, stouter than the arm; dactyli obtuse and spoon-shaped at end, the movable one with a single tubercle on the inner margin.

Hinder limbs tubercular on upper surface; carapax and chelipeds without tomentosity, but a few hairs scattered on the hinder limbs. Females much smaller than males; the chelipeds small, about equal in length to the second pair.

Locality—Gulf of California.

	♂ M. M.	♀ M. M.
Length of carapax	16	13.5
Length of first pair	27	11.5
Length of second pair	15	12
Width of carapax across the posterior portion, where widest	14	12

The areolets of the carapax are prominent, but without spines; but the two largest posterior lobes of the antero-lateral margin are tubercular, and there are a few small tubercles on each postero-lateral margin.

Color, in spirits, uniform reddish.

No. 15. Several specimens, both sexes, in spirits. Fisher and Lockington

24. *Mithraculus coronatus.* Stimpson. Amer. Jour. Sci., second ser., XXIX, 1860, p. 132; Am. Lyc. Nat. Hist., New York, VII, p. 186; White (?), List. Crust. Brit. Mus., p. 7; T. Hale Streets, Proc. Acad. Nat. Sci., Phil., Dec. 5, 1871, p. 239.

This species is mentioned by Hale Streets in his "Catalogue of Crustacea from the Isthmus of Panama, collected by J. A. McNeil," but that author does not state whether the specimens were from the Pacific or Atlantic shore of the Isthmus. It is found at Aspinwall and along the Brazilian coast.

TYCHIDÆ.

25. *Tyche brevipostris*. Nov. sp.

Carapax an elongated rectangle with sinuate sides; rostrum short, depressed; laminate; pre-orbital spine long, elevated, produced almost as far forwards as the rostrum when viewed from above. A thin broad lobe behind the pre-orbital spine, concealing the elongated eyes except at the tip. Fixed joint of outer antennæ narrow, and boldly relieved from the surrounding parts, second and third joints cylindrical. Peduncles of eyes inserted level with the fixed joint of antennæ. Anterior portion of carapax bent downwards, posterior portion shield-shaped, the lateral and posterior margins overhanging, the latter thin. First pair of limbs shorter than second, scarcely projecting beyond the carapax. Second pair about as long as carapax, slender; succeeding pairs similar.

	M. M.
Length of carapax..	17
Width of ditto	11

A single female specimen from Port Escondido, Gulf of California.

The general aspect of this little crab is that of a dried leaf; the anterior portion, deflected and somewhat pilose, does not attract the eye, while the shield-shaped posterior portion is very conspicuous. From the central tubercle of the gastric region, which is the most elevated portion of the carapax, a ridge is continued outwards on each side to the margin of the carapax, the surface of which is increased by expansions with sinuate edges. The whole of this leaf-like posterior surface is inclined in the opposite direction to the frontal portion. The pre-orbital spines project like a pair of horns immediately in front of the eye-shields, each of which is an obtuse isosceles triangle with its apex directed laterally.

As the specimen is a female it is impossible to be certain whether the small chelipeds are characteristic of the species, or of the sex only. I have placed this species in the genus *Tyche* of Bell, with which it has the following characters in common: Eyes without orbits, hiding below the carapax, which is oblong, wide in front and broad across the orbits, depressed, without post-orbital spines, and with pre-orbital spines produced to a line with the rostrum; first joint of external antennæ long, unarmed.

This form differs, however, from the generic description as given by Dana, in the shortness of the rostrum, which is bent downwards, but not more so than the anterior portion of the carapax.

EURYPODIDÆ.

26. *Oregonia gracilis*. Dana. U. S. Ex. Exp., I, 106, pl. III, f. 2. Stimpson. Crust and Echi. Pac. S. N. A., 16.

27. *Oregonia hirta.* Dana. U. S. Ex. Exp., I, 107, pl. III, f. 3. Stimpson. Crust. and Echi. Pac. S. N. A.

Both the *Oregoniæ* are found in deep water. Locality, Puget Sound. I have not seen either of these species.

28. *Leptopodia debilis.* S. I. Smith. Rep. Peabody Acad. Sci., 1869. Panama, Pearl Islands.

A single specimen of this species was found in Mr. Fisher's collection, from the Gulf Coast of Lower California.

29. *Inachoides (Microrhynchus) Hemphillii.* Lockington. Proc. Cal. Acad. Sci., February 7, 1876.

I have been in some doubt whether to refer this species to *Inachoides* or *Microrhynchus*, but as the eyes are tolerably elongated and do not appear to be retractile within the small orbits, I prefer the former. On the other hand, it differs from both genera in the absence of a post-orbital spine, unless a single spine on the antero-lateral margin, situated almost the length of the rostrum behind the eyes, can have a right to that name. The rostrum is one-fourth the length of the posterior portion of the carapax. The want of a post-orbital spine scarcely warrants the establishment of a new genus, but the definition of the genus *Inachoides* must, to admit it, be altered slightly, thus—

Inachoides. Edwds and Lucas. *Carapax valde gibbosus rostro longiusculo, acuto, spina post-orbitali parva aut nulla. Pedes* 8, *postici sat longi, gracillimi. Articulus antennarum externarum Imus angustus.*

The words *aut nulla* admit the present species. Localities—San Diego, San Luis Obispo, both in Upper California; La Paz, where it has been dredged from a bottom of sand and mud; San José Island; Amortiguado Bay; Port Escondido; Mulege Bay—all in the Gulf of California. The largest specimen I have seen, a male, exceeds in size the type in the possession of the Academy. The dimensions are as follows:

	M. M.
Length of carapax, including rostrum.	34
Greatest width of ditto	13
Length of first pair.	40
Length of second pair	70

One of the largest females measures 15 M. M. in length and 8 in width. The carapax of this species is free from the parasitic growth, often so abundant on maioid crabs.

No. 2. Male, San Diego, 7 fms. Hy. Hemphill.

30. *Inachoides brevirostrum.* nov. sp.

Carapax pyriform, the regions in the central line of the body more elevated than the lateral regions. Rostrum short, simple, consisting of the spinous termination of the septum dividing the fossettes of the inner antennæ. Opposite the anterior extremity of each fossette an acute tooth, so that the ros-

trum is somewhat trifid. Eyes long, not retractile. A small pre-orbital spine. Fixed joint of external antennæ prolonged externally into a short but acute spine; movable joints not concealed under the rostrum. First pair of feet shorter than the second in the male, than the third in the female; slender, cylindrical, the dactyli straight, in contact throughout their whole length, and almost equal in length to the manus. Four hinder pairs slender, cylindrical, the second rather more than 1¾ times the entire length of the carapax. Carapax and abdomen tomentose, chelipeds tomentose, four hinder pairs ciliate, sides of rostrum ditto. Locality, Magdalena Bay, L. C.; dredged at a depth of three fathoms. Four females and one male.

	♂ M. M.
Length of carapax	9.5
Width of ditto	6.

The females are wider in proportion than the males. Notwithstanding the comparative shortness of the rostrum, and also of the carapax, the characters of the eyes and antennæ prove this species to be an *Inachoides*.

PERICERIDÆ.

PERICERINÆ.

31. *Pugettia gracilis*. Dana. U. S. Ex. Exp., I, 117, pl. IV, f. 3. Stimpson. Crust. and Echi. Pac. S. N. A., 16.

Localities—Puget Sound, Vancouver's Island; Mutiny Bay, Alaska; San Luis Obispo.

No. —. Male, in spirits, Vancouver's Island.

No. 19. Female, in spirits, Mutiny Bay, Alaska. Presented by Alaska Commercial Company.

32. *Pugettia Richii*. Dana. U. S. Ex. Exp., I, 117, pl. IV, f. 4. Stimpson. Crust. and Echi. Pac. S. N. A., 17.

The only locality at present certainly known for this crustacean is San Diego. Dana says of his specimen, "From California."

No. 9. Several dried specimens from San Diego. Henry Hemphill.

33. *Pellinia longioculis*. nov. sp.

Posterior portion of carapax broadly triangular, post-orbital spine expanded, trans-orbital width rather less than half the greatest width; rostrum short, stout, bifid. Stomachal region prominent. Fixed joint of external antennæ emarginate at apex, the outer tooth acute, not longer than the inner. Peduncles of eyes about equal in length to the distance between the eyes. First pair of feet about equal in length to the second and to the length of the body; meros tuberculate; hand thin, broad, smooth, marbled; fingers touching at the extreme tip only; a tooth on the inside of the movable finger near its base-

Four hinder pairs short, slender, cylindrical, setose, except the tarsus, which is smooth and shining, like the manus of the first pair. Carapax and abdomen tomentose above and below. A single specimen, male, found among a number of another species from different localities, so that its locality is uncertain, further than that it is from Lower California. Length and breadth nearly equal, about eight millimetres.

This species differs from *Peltinia*, Dana, in the length of the eyes. The antennæ are not hidden by the rostrum, so that it is impossible to place it among the *Epialtinæ*. It appears to me to be in its characters intermediate between *Acanthonyx* and *Epialtus*, and therefore should find a place in *Peltinia*, but to accommodate it the character, "*Eyes not retractile, short,*" must be changed to "*Eyes not retractile, of variable length.*"

EPIALTINÆ.

34. *Epialtus productus.* Randall. J. A. N. S. Phil., VIII, 110. Gibbes. Proc. Am. Asso., 1850, p. 173. Dana. U. S. Ex. Exp., I, 133, pl. VI, f. 2.

The figure in Dana's work represents the female, which differs so much from the male that it might easily be mistaken for a distinct species. The largest specimen in this collection is a male from Santa Rosa Island, Cal., collected and presented by W. G. W. Harford. This specimen displays well the differences between the sexes. It is armed with a large pair of chelipeds, the hand and fingers of which equal in length the breadth of the carapax. The four hinder pairs of legs are long and slender, and the carapax in all its dimensions greatly exceeds that of the female.

No. 4. Male, fine specimen, dried. Santa Barbara. W. G. W. Harford.
No. 5. Female, dried. Donor unknown.

35. *Epialtus Nuttallii.* Randall. *loc. cit.*, VIII, 109, pl. III. Gibbes. *loc. cit*, p. 173.

It is rather strange that this crustacean should not have found its way into our collection. Randall gives "Upper California" as its locality.

36. *Epialtus minimus.* Lockington. nov. sp.

Rostrum larger than usual in the genus, the emarginated extremities divergent. Trans-orbital width small. No pre-orbital or post-orbital spine. Antero-lateral margin with two triangular teeth, the anterior much the largest, their front margin at right angles to the carapax. Without the anterior of the teeth, the form of the carapax would be triangular. Distance from the anterior line of the first teeth to tip of rostrum about equal to the posterior portion of the carapax. First pair of feet in the male longer than the second, fingers obtuse and imperfectly spoon-shaped at their tips. Eight posterior feet slender, cylindrical, naked, except terminal joint, which is fringed below with short setae. Penultimate joint with one or two small spines on

the under side. Localities—Port Escondido, San Jose Island, both in the Gulf of California. Found at low tide under stones and in coral.

	♂	♀
	M. M.	M. M.
Length of carapax	14	14
Width of ditto	11	12
Length of first pair	18	..

The carapax of the largest female is stouter and broader than that of the largest male, but the latter more than makes up for this deficiency by the extra length of his chelipeds. In some of the females the manus is tuberculated, but is smooth in the males and in other females.

No. 17. Male and female, in spirits. Fisher and Lockington.

PARTHENOPIDÆ.

37. *Parthenope* (*Lambrus*) *punctatissima*. Owen. Zool. Beechey's Voyage, 81, pl XXIV, f. 4. Stimpson. Crust. and Echi. Pac. S. N. A., 18.

38. *Lambrus frons-acutis*. Lockington. Proc. Cal. Acad. Sci., Feb. 7th, 1876.

From Boca de Los Piedras, Sinaloa, Mr. W. J. Fisher brought two small specimens.

No. 8. Santa Catalina Island. Hy. Hemphill (dried).

39. *Cryptopodia occidentalis*. Dana. Am. Jour. Sci., 2d ser., XVIII, 430. Gibbes. Proc. Elliott Soc. Nat. Hist., Charleston, S. C. Stimpson. Crust. and Echi. Pac. S. N. A., 18.

Dr. Kellogg read the following paper:

Ludwigia Scabriuscula.

BY DR. A. KELLOGG.

Stem annual, erect, branching from the base, somewhat scabrous throughout, slightly decurrent-angled; leaves opposite—upper small (½-inch long; one or more lines wide), sessile, oblong-linear acute; base subclasping margin entire, or obsoletely toöthed and scabrulose; flowers axillary, sessile or subsessile, solitary or clustered—six to nine or more in a whorl involving the stem; petals whitish, obovate-cuneate; claw short, nearly as long as the capsule—two to three times the calyx; stigma, four-lobed and capitate, style twice longer than calyx; capsules, ovoid, subquadrangular, angles slightly marked (eight-angled chiefly near the truncate apex; the four intermediate angles often processed into obsolete secondary teeth). Seeds obovate, minutely roughened and very obtusely striate; reddish brown. Muddy margins of streams and lakes; spicate fruited throughout main stem and branches. The lower leaves are wanting in several collections; intramarginal veins exceedingly obscure in the upper lesser leaves.

W. N. Lockington read the following:

Remarks upon the various Fishes known as Rock Cod.

BY W. N. LOCKINGTON.

Probably the most abundant fish in our markets are those known as rock cod. At least seventeen species are thus called, eleven of them belonging to Cuvier's genus *Sebastes*, four to *Chiropsis*, and those others to as many separate genera.

In 1854, and the subsequent years, as will be found by reference to the first volume of the "Proceedings of the California Academy of Sciences," the distinguished icthyologist, W. B. Ayres, described eight species of *Sebastes*, besides a large number of other fishes—about sixty-eight in all. Of the eleven species of *Sebastes* described by Ayres and Girard, we have within these last two months found in the markets all but three, viz: *S. nigrocructus*, Ayres; *S. elongatus*, Ayres; and *S. ovalis*, Ayres. The first of these, distinguished by several black bands across its body, is well known to the fishermen; of the second, which is characterized by its elongated body and light yellowish brown color, with blackish brown spots, the Academy possesses a specimen; but I have not yet seen the third, and Dr. Ayres himself states that it is rare.

S. ruber. Ayres. This species attains a large size and a weight of from ten to twelve pounds. It is of an almost uniform bright red, with a great abundance of small accessory scales on the large ones.

S. helvomaculatus. Ayres. This rosy-tinted fish may readily be distinguished from *S. ruber* and *S. rosaceus*, not only by its much smaller dimensions, but also by the row of three bright pink spots which adorn each flank. It does not appear to exceed a foot in length. In the month of June it was frequently brought into our markets.

S. rosaceus. Girard. About this species there is still some ambiguity, and it is not unlikely that two distinct forms are confounded under this name. The name was first applied by Girard to a large species of *Sebastes* figured in the P. R. R. Rep., vol. x, pl. xxii, and incorrectly supposed by that naturalist to be the same with the *S. ruber* of Ayres. Girard's figure is in many respects faulty, and in his description he refers to an error in the form of the caudal fin, which is drawn rounded, while in the fish it is sub-concave. The outline figure given by Ayres at Pro. Cal. Acad., vol. ii, fig. 62, is more correct, but Ayres gives no description. As I have lately had the advantage of handling several specimens, I think it may be well to notice a few particulars, some of which are not mentioned by Girard. The ventral fins are long and pointed, nearly equaling the pectorals, and extending beyond the vent; the pectorals also are long and pointed, the longest rays extending to within four scales of

a perpendicular drawn from the first anal spine; and the rays of both these pairs of fins are slim and delicate.

The second spine of the anal fin is stoutest, but is shorter than the third; the first soft rays of the anal are very long, much exceeding the posterior rays, and extending to the origin of the exterior rays of the caudal; and the caudal fin is most distinctly sub-concave, with the line of the outer fin rays continued forward as a ridge for some distance along the caudal peduncle. The two lower spines of the pre-operculum are more developed than in Girard's plate, and the spinous dorsal is more correctly shown in Ayres' outline figure. Ayres has, however, omitted the characteristic broad short spine situated directly over the centre of the maxillary.

Girard gives his *S. rosaceus* "two pairs of small and horizontal spines" upon the upper surface of the head. The specimens we examined were provided with five pairs of spines, none of them very conspicuous. There are two long, low, orcipital spines, between which and the eyes are three pairs of very small spines; a fourth pair (supra-orbitals) occurs on the extreme edge of the upper margin of the orbit, above the pupil; the space between the eyes is unarmed, and the fifth pair is situated between the nostrils.

Girard gives the color as "a uniform reddish or crimson tint, lighter beneath than above," characters which agree with *S. ruber*. *S. rosaceus* is far from uniform in tint when fresh, the upper portion of the head and back being extensively blotched with a darker red than the ground tint, inclining to brown. In view of all these differences, I think it not improbable that Girard's figure may be that of another species which I have not yet seen, in which case Ayres' species would no longer be *rosaceus*, and might fitly be named *S. Ayresii*. I may here mention that I have had a large specimen brought to me from deep water, and presenting several differences from the typical *S. rosaceus*, but, as it is deformed about the jaws and dorsal fins, I think it best at present to include it under that species.

S. nebulosus, Ayres, is a tolerably common fish in our markets, and is perhaps one of the most beautiful of this gorgeously colored genus of fishes, adorned as it is with yellow bands and blotches upon a dark, almost black, ground. The largest specimen in the collection of the Academy is eleven inches long, but has a girt of nine inches and a half; this species being one of the stoutest and deepest of the genus. I subjoin measurements of another specimen which came into our hands:

	Inches.
Length	11
Length of head	3
Girth in thickest part	10.2
Length of spinous dorsal	4
Length of caudal fin	2
Length of pectorals	2.5

S. paucispirus. Girard. This is one of the most singular fishes of the genus, its lower jaw reaching forward and upward so much that the tip of the mandible continues around the cone of the dorsal outline. This species is far

from common. Following are the dimensions of a specimen recently presented to the Academy:

	Inches.
Total length	5.3
Length of head	4.8
Length of spinous dorsal	4.5
Length of caudal	3
Length of ventrals	3
Length of lower jaw	3.5
Girth in thickest part	3.7
Diameter of eye	1

S. melanops. Girard. In the month of June this species was abundant in the markets. It is a sober-colored fish, attired in black and gray, the black in varying proportions upon the lighter ground; and in size it is usually superior to *S. ruber* and *S. rosaceus.*

S. flavidus. Ayres. This species is not so uncommon as Ayres believed it to be when he described it. During June of this year it was nearly as abundant as *S. helvomaculatus*, *S. melanops*, or *S. auriculatus*, and more so than either species of *Sebastes*. It is readily distinguished by the greenish brown and yellowish green tints of the back and sides, as well as by the third spine of the anal fin, which is longer than the second, instead of about equal to it, as in *S. melanops*, which is a closely allied form. The largest specimen seen by us measured as follows:

	Inches.
Total length	15.5
Length of head	4.2
Length of spinous dorsal	4.2
Length of caudal	3
Girth in thickest part	10
Diameter of eye	1

S. auriculatus. Girard. This fish can always be distinguished by a black mark upon each of the gill-covers, very obvious in the younger fish, and sufficiently distinct, though less clearly outlined, in older specimens. The general color is a dull reddish brown, with cloudings of a darker tint upon the back and sides; these cloudings, like the black spot before mentioned, becoming more diffused and indistinct with increasing size and age. This appears to be the only species of *Sebastes* which frequents the Oakland side of the bay, where it is very commonly taken with hook and line from the railway wharf. The bay upon the Oakland side is less saline than at San Francisco, the influx of the tide damming up the fresh waters of the Sacramento and other smaller rivers and creeks, and throwing them toward the main-land. Many of the marine fishes, therefore, do not visit this side, while salmon are frequently taken there. A large *S. auriculatus* measured as follows:

	Inches.
Length	16.5
Depth at origin of first dorsal	4.7
Length of dorsal	8.5
Length of head	4.3

Anarhichthys felis. Girard. This rapacious fish, a near relative of the wolf-fish of the Atlantic, attains a large size. One obtained recently in the market measured four feet nine and a half inches from snout to tip of caudal fin, and one of larger dimensions was received by the Academy last year, but was lost for want of a vessel sufficiently large to contain it in spirits. The specimen described by Girard was only fifteen inches long. Some few weeks ago I saw in the papers an item detailing how some one in the north of this State had found an "infant sea-serpent" seven feet long, with a long fin on the back and another below, both reaching to the tail, a conical head and large teeth, etc. The description was, in fact, a tolerably correct one of a specimen of this fish of about the size of that sent to the Academy. It is not very common, but is occasionally brought to market, and is eaten by the Chinese.

Regular Meeting, August 7th, 1876.

Dr. A. B. Stout in the Chair.

Sixty members present.

Donations to the Museum: From Capt. H. Johnson, ovary of viviparous perch, larva of *Prionus Californicus.* From J. P. Dameron, specimen of *Gillichthys mirabilis.* From Wm. J. Fisher, specimens of *Conorhynchus, sphyræna, argentea, Tetraodon polita, Mustelus Californicus, Trachynotus ovatus, Paralabrax nebulifer, Sasmicossiphus pulcher, Argyreiosus Pacificus, Gelasimus princeps, Grapsus strigosus.* From J. M. Middleton, five specimens of cinnabar from Sulphur Banks, Lake County. From Henry Edwards, one specimen of silver ore from Austin, Nevada, five specimens crystals of cinnabar from interior of chimney of furnace, Lake County. From Governor Wm. Holden, two specimens silver ore from Elko District, Nevada. From Mr. Glass, calc-spar and asbestos from Calaveras County. From A. J. Severance, two specimens of greenstone (diamond drill core), from Yuba County, and two specimens of silver ore

from Nye County, Nevada. From C. D. Gibbes, four specimens of coal from Australia, Nanaimo and Mt. Diablo.

W. N. Lockington read the following:

Notes on some California Marine Fishes, with Description of a New Species.

BY W. N. LOCKINGTON.

Mr. W. J. Fisher, formerly Librarian of this institution, is now engaged in collecting objects of Natural History on the coast of Lower California. I have up to this period received two consignments from him, consisting of skins of birds and mammals, shells, crustacea, and a few reptiles and radiates.

As the Academy kindly assisted us by furnishing alcohol, and as we wish to do our best to make the collection in this building a complete one as regards Californian species, we shall from time to time, as we are able to identify and describe them, present specimens of such forms as are not in its possession.

The work of identifying is necessarily slow, and our time limited. It is intended for the future to furnish notes with the specimens presented—fishes, crustacea, etc. Our time has hitherto been occupied entirely with the fishes and crustacea.

Among the former are two or three forms which I believe to be new, and several others which are not brought into our markets, although they have been described by Ayres or Girard, and range as far north as San Francisco Bay.

We present this evening specimens of such of these as we have been able to identify or describe, and the greater part of these notes relates to the specimens presented.

Mr. W. G. W. Harford, who has assisted me greatly, has himself taken most of the measurements given in this paper.

Albula conorhynchus. Gunther.

Among the fishes forwarded to us, the only soft-finned ones were two beautiful specimens of about the size of a mackerel, glowing with gold upon the sides, and with darker metallic reflections upon the back, the prevailing tint, however, especially below, being that of burnished silver.

I should have believed them to be fresh water fish had I not known that everything from the waters yet sent by Mr. Fisher was marine. Unfortunately the label attached was so injured by the alcohol that it was lost in unpacking.

The structure of the teeth, however, proved the fish to be no cyprinoid, and the absence of an adipose fin "counted out" the salmon and other families. One of the clupeoid or herring family, therefore, it must be, both by its structure and its marine habitat. Yet it seemed a very singular herring, with its rounded abdomen (the herrings mostly have a sharp abdomen)

and the curious yellow gelatinous membrane, which covered the eyes so as to leave no outward trace of the orbit.

On examining the genera and species of clupeoids given in Dr. Gunther's valuable catalogue, I found, however, one species, the only one of its genus, and this the only one of its tribe, characterized, among other things, by a flat abdomen (which I take to mean not sharp as in the rest of the family), and an "adipose membrane covering the eye." I therefore concluded that my fish was an example of that singular species, and my belief was strengthened by the close agreement of all the other characters, as the number of fin rays, position of mouth, teeth, etc.

The only difference I noted was in the color, which Gunther gives as "uniform silvery," but it must be remembered that these specimens were much fresher than Gunther's could be; and the much greater prevalence of the gold and dark metallic reflections in one of the specimens than in the other, appears to show that the tints are variable. This point I hope to settle ere long, by the aid of Mr. Fisher.

Following are the dimensions of one of the specimens:

	Inches.
Length	3.7
Length of head	3.5
Length of base of dorsal	2.5
Tip of snout to origin of dorsal	6.
Length of caudal	3.
Tip of snout to base of anal	8.
Girt in thickest part, just in advance of dorsal	7.

This species has been found in the Atlantic and Indian Oceans, and one of Gunther's specimens was from the Pacific Coast of Central America, but I do not find that it has previously been reported from the North Pacific.

Argyreiosus Pacificus, n. sp.

Greatest height of dorsal outline, immediately behind the eye; greatest depth of body, immediately in front of anal. Proportion of length to greatest depth, about as 7 to 15. Lower jaw longer than upper. None of the rays of spinous dorsal elongated. First three rays of soft-dorsal very long, next two decreasing, the remainder nearly equal. No free spines in part of anal. First articulated ray of anal much elongated. First three rays of soft-dorsal undivided, the others much branched. Membrane between rays of anal very short, rays much branched, except the first, so that the anal appears to consist of many finlets, especially when depressed. Dentition and brancheostegals, normal. Pectorals very long, one-third the total length of the fish. Fourth, fifth and sixth rays (counting downwards) the longest. Ventrals very short and small. Dorsal outline depressed behind snout, then nearly perpendicular to above posterior edge of orbit, thence almost straight to origin of soft dorsal, thence rounded and rapidly narrowing to peduncle of tail. Caudal lobes very long and narrow. The greatest thickness of the fish is between the eyes and the base of the pectorals. Formula of fins: D. 4 or 5, $\frac{1}{24}$; A. $\frac{1}{19}$; P. $\frac{1}{16}$; V. $\frac{1}{5}$.

Numerous specimens of this species caught in Magdalena Bay have been examined by us, and careful comparison with the forms described in Gunther's catalogue has led me to the conclusion that this is a new species. From *A. vomer* it differs in the extreme shortness of its ventrals, none of the rays of which, or of the spinous dorsal, are continued into filiform prolongations; also, in the greater proportional length of the pectorals. From *A. setapinnis* it can be at once distinguished by the prolongation of the first rays of the soft dorsal and the anal.

The dimensions of a large specimen are as follows:

	Inches.
Extreme length in straight line from the tip of lower jaw to tip of lower lobe of tail	15.5
Extreme height in front of anal fin	7.2
Height immediately behind eye	6.65
Greatest girth	14.60
Length along profile from tip of lower jaw to origin of soft dorsal	10.60
Length from tip of lower jaw to origin of anal	6.75
Length of base of soft dorsal	5.60
Length of base of anal	5.50
Length of base of pectorals	.62
Length of head above orbit	3
Length of pectorals	5.45
Length of ventrals	.5
Length of caudal to division of lobes	2.25
Length of lower lobe of caudal from fork	3.40
Length of upper lobe of caudal from fork	2.95
Length of longest ray of dorsal	4.10
Length of longest ray of anal	3
Length of lower jaw	1.8
Distance from tip of lower jaw to orbit	2.65
Diameter of orbit	.75
Greatest thickness of fish	1

One or two specimens exceeded these dimensions.

Cestracion francisi. Grd. U. S. P. R. R. Rep., vol. x, p. 365.

Of this genus of sharks, so interesting from its occurrence in geological time as far back as the Devonian Age, only four species now exist; one of these, *C. phillipi*, is the often-mentioned Port Jackson shark; another, *C. francisi*, has been caught in the Bay of Monterey, and occurs along the coast at least as far south as Magdalena Bay, Lower California, from which place we received a single fine specimen, the dimensions of which are appended:

	Ft.	*In.*
Length from tip of snout to tip of caudal	2	6¼
Length from tip of snout to origin of first dorsal		8⅝
Length from origin of first dorsal to origin of second dorsal		8½
Circumference immediately in front of first gill-opening	1	1¼
Circumference immediately in front of pectorals	1	1¾

Circumference immediately behind first dorsal	11
Circumference immediately in front of second dorsal	$6\frac{1}{8}$
Distance from tip of snout to eye	$2\frac{3}{4}$
Longitudinal diameter of eye	$\frac{5}{8}$
Breadth between supra-ocular ridges	$2\frac{1}{4}$
From spiracle to tip of snout	$3\frac{1}{4}$
Length of pectorals along anterior edge	7
Height of first dorsal spine	$2\frac{1}{8}$
Length of base of first dorsal	2
Length of base of second dorsal	$2\frac{1}{2}$
Length of claspers from opening of anus	$4\frac{1}{8}$
From anus to tip of snout	1 $1\frac{3}{4}$
Width between angles of mouth	$3\frac{1}{4}$

Trachynotus ovatus? Gunther.

Among our fish were several specimens which appeared to agree in every respect with Girard's genus *Doliodon* (*Trachynotus*, Gunther), and to be very near the species named by him *Doliodon carolinensis*. A comparison of proportionate dimensions, however, induces me to consider it as belonging to the long-known species *T. ovatus*, which has previously been found in almost every sea from the east coast of North America to the shores of Australia. The dorsal spines are, one directed forward, six with membrane attached, and one at origin of soft dorsal. The principal measurements of the specimen presented are as follows:

	Inches.
Extreme length	11.62
Extreme depth from dorsal to anal	5.12
From tip of upper jaw to tip of first dorsal spine, following outline	4.0
Thence to origin of soft dorsal	1.75
Length of base of soft dorsal	3.25
Length of vase of anal	3.0
Length of vase of pectorals	0.5
Length of pectorals	2.12
Length of ventrals	0.95
Greatest girth	10.62
Girth at base of pectorals	8.5
Length of head	2.75
From orbit to tip of upper jaw	0.55
Diameter of eye	0.60
Greatest thickness of body between eye and pectorals	1.25

One of the specimens was at least one-third larger in every dimension.

Paralabrax nebulifer. Grd. P. R. R. R., x, p. 33, pl. xii, fig. 1-4.

This species does not, so far as I know, occur near this vicinity, as I have not yet detected it in the market. We have several specimens from San Bar-

tolome Bay, Lower California, where they were taken among kelp. The largest specimen measures as follows:

	Ft.	*In.*
Extreme length	1	$5\frac{1}{8}$
From snout to posterior edge of operculum		$5\frac{1}{2}$
Base of dorsal fin		$7\frac{1}{8}$
Base of spinous portion of fin		$3\frac{1}{2}$
Circumference in front of pectorals		$10\frac{1}{9}$
From snout to origin of dorsal		$5\frac{1}{9}$
From snout to origin of anal		11
Length of pectorals		$3\frac{1}{2}$
From snout to origin of pectorals		$5\frac{7}{10}$
Length of ventrals		3

Triacis semifasciata. Gnthr. (*Mustelus felis.* Ayres.)

This is one of the commonest sharks of San Francisco and Tomales bays, and is also found on the coast of Lower California. Ayres described it as a *Mustelus*, but its teeth, though somewhat pavement-like, and, in many cases, have points or cusps, whereas in *Mustelus* they are wholly smooth. Both this species and *Mustelus Californicus*, Gill, are commonly called "dog-fish," but, though from their small size, they resemble the real dog fish or *Scylliadæ*, they differ from them greatly in their teeth, and in the absence of a nictitating membrane to the eye. A large specimen, procured in this bay, measured as follows:

	Ft.	*In.*
Tip of snout to end of tail	4	3
Tip of snout to origin of first dorsal	1	3
Origin of first dorsal to origin of second	1	4
Length of base of second dorsal		4.5
Greatest length of pectorals		8
Length of head on back		8
From anterior margin of lower lip to origin of anal	1	10
Snout to anterior margin of lower lip		3.25
Greatest circumference at origin of anterior dorsal	1	6

Mustelus Californicus. Gill.

This is the common "dog-fish" of San Francisco Bay. It does not usually attain the dimensions of the species last named, and is easily distinguished from that prettily marked species by its plain uniform slaty hue, becoming whitish beneath.

Semicossyphus pulcher. Gunther. (*Labrus pulcher.* Ayres.)

This fish was the first of the sixty-eight Californian species described by Dr. W. O. Ayres, and its description forms the first page of the first volume of the proceedings of this Academy. The smaller number of spinous rays in dorsal, the presence of a posterior canine tooth, and the absence of scales on

the pre-operculum, do not allow of its classification in the genus *Labrus*, and Dr. A. Gunther considers those peculiarities sufficiently marked to warrant the formation of a new genus for its reception. Fortunately for us, we have a very full series of specimens; had it not been for this, the extreme forms would certainly be considered distinct species. Not only the coloration, but the form of the head, varies greatly, but the variations will be found, on comparison of a number of specimens, to shade into each other, and the extreme forms are found along with each other among the floating kelp. Some of the specimens were taken at a depth of eight fathoms, but still near kelp. A label attached to a highly colored specimen gives the following particulars of the colors when fresh:

"Iris golden, with a red rim; head to pectorals black, including upper jaw; lower jaw white. Pectorals, ventrals, caudal and dorsal, black. Body from head to a perpendicular from behind anus, deep red, shading into light red under belly. From anus to end of caudal, black."

One of the largest specimens measured as follows:

	Ft.	*In.*
Total length	1	6
Base of dorsal fin		7.1
Height of soft dorsal		3.5
Length of spinous portion of dorsal		5
Length of base of anal		3.5
Height of anal		2.5
Length of base of ventral		1
Length of ventral		3
Greatest depth of body, at origin of soft dorsal		5.5
Greatest girth at origin of soft dorsal	1	1
Length of tail		3
End of snout to origin of dorsal, following the outline		6.5

Sphyræna argentea. Grd.

Of this rare species one large specimen and three smaller have been sent to us. The largest measured as follows:

	Ft.	*In.*
Extreme length	2	10.5
From tip of lower jaw to posterior edge of operculum		9
Base of first dorsal		2.6
Tip of lower jaw to origin of first dorsal	1	1.2
Base of second dorsal		2.6
Tip of lower jaw to origin of second dorsal	1	9.5
Length of tail		5.2
Girth in front of pectorals		8.4
Tip of lower jaw to anterior rim of orbit		4
Diameter of orbit		1.1

C. W. Kreuger was introduced by Mr. Troyer and delivered a lecture on "Flying Machines," exhibiting and explaining at the same time a model of a flying machine of his own invention.

REGULAR MEETING, AUGUST 20TH, 1876.

Vice-President Hyde in the Chair.

In addition to the usual exchanges there were presented to the Library two volumes of the Annals of the Observatory of Madrid, and two volumes of Hayden's U. S. Geological Survey.

Dr. Kellogg read the following:

Notes and Descriptions of some Californian Plants.

BY DR. A. KELLOGG.

Dr. G. Eisen, of Sweden, placed in our hands for determination his plants collected near Fresno, Cal. A species of *mimulus* appears to be new.

Mimulus Eisenii. K.

Viscid-glandular chiefly above, somewhat pubescent throughout, ½-1 foot branching from the base, whole plant more or less purplish. Radicle and lower cauline leaves 1-2 inches long, on slender petioles; laminal outline ovate-oblong, oblong, or oblong-subspatulate, pinnatifid, rachis nerved, narrowing into the petiole, which from long becomes equal in the lower cauline, at length very short toward the summit, but all petiolate; lobes variably denticulate, somewhat hispid and cilliate, simply denticulate-pinnatifid in the upper reduced leaves; peduncles subsetiform as long as the flower; calyx colored, pinkish above, yellowish beneath dotted with large purple spots in lines chiefly on the upper side, at length becoming oblique ⅓-⅙ the peduncle; teeth somewhat triangular-acute, lower a little shorter or subequal in flower, 1-2 lines, carinately incurved, closing the throat toward maturity; upper tooth elongating to apparently twice the length of the lower or nearly half the length of the calyx upwardly curving; corolla yellow, a single lower lobe often white, about five lines or twice the calyx; tube slender, throat expanding, lobes about equal; capsule oblong, obtuse, narrowing at the base into a short stipe.

Also a *Vicia*, which appears to be new.

Vicia nana. K.

A very low (3-6 inches) and slender perennial, erect or ascending, flexuous, sub-four-angled, branching from the base, finely pubescent or nearly glabrous throughout; leaves short, about one inch, tendrils simple or rudimentary; leaflets one to three pairs (or more?), thin nerved, obovate or oval-elliptic, mucronate about half-inch long; stipules narrow lance-acuminate, entire, de-

flexed subulate lobe one-half to one-third shorter; peduncles 2–3 inches long, or about twice the length of the leaves (rarely equal), 3–6 flowered; flowers large, three-quarters to one inch long, calyx ten-nerved, obliquely tubular-campanulate; teeth shorter than the tube, two upper slightly shorter, banner, purple blue; the short wings and keel whitish; staminal sheath very oblique; stigma finely villous, a line or so on both sides; pod glabrous, one inch or more in length, flat linear-oblanceolate, narrowing to a short stipe; 12-14 seeded.

Mr. Samuel Brannan, Jr., placed in the Academy Herb. a new plant collected by him on the top of Granite Mount, Oak Creek, Kern County, April 1st, 1871.

Phacelia Brannani. K.

A low spreading annual, four inches to a span high, much branched from the base, densely minute canescent puberulent throughout, and viscid villous-glandular above; racemes scorpoid, becoming opposite the upper leaves; leaves oblong in outline—2–3 inches long, ½–¾ inch broad—petiole ¼–⅓ the length, bipinnate, lobes subsessile, few pinnatifid above, oblong, crenate and incisely-crenate toothed or subpinnatifid with roundish lobules of variable size and order; corolla open funnel form with a broad campanulate border; lobes rounded, bright blue, genitals included; filaments naked, somewhat infolded at the base; style shortly bifid, hirsute below; calyx lobes shorter than the tubes, spatulate-linear, about twice the length of the oval hirsute capsule; seeds oblong, compressed, centre depressed, the thickened margin transversely corrugated; about 12-seeded.

Lathyrus splendens. K.

Stem-climbing, perennial, quadrangular, somewhat striate, subpubescent, mostly glabrous, often glaucous; leaflets about eight, scattered, very variable, linear to lanceolate and ovate-lanceolate or oblong on the same specimens, acute, mucronate, strongly three to five-nerved and veined, reticulate, glabrous above, rarely subpubescent beneath, petiolules hirsute; common petioles about equal, subtrigonal, slightly channeled above or margined, puberulent, relatively stout, tendrils two to five-parted; stipules small, semi-saggitate and semi-lunate, upper longer lobe acuminate, subfalcate, entire, or rarely laciniate, notched or toothed, lower mostly repanddentate; peduncles stout, about equal, rarely becoming a little longer than the leaves, seven to ten-flowered, flowers very large, scarlet-purple, pedicels pubescent, two to three times the length of the calyx, articulated; calyx obliquely campanulate, pubescent, eighteen-nerved, upper teeth remote, very short, triangular-acute; the lateral, sublanced nearly twice as long as the upper, and a third less than the lower subulate tooth, which is about equal to the tube; banner about one inch in length and nearly as broad, emarginate, reflexed; keel an inch or more in length by half an inch in depth, acute or subacute; wings narrow, shorter; style clavate, somewhat flattened and folded, or grooved on the outside next to the keel, villous along the inside, one-third to one-half its length; pods three inches in length, glabrous, compressed, symmetrical, 10 to 20 seeded,

color cinnamon brown, inside of the valves silvery satiny; seeds about half the size of common pea, verditer-greenish hue; allied to *L. polymorphus*. A climbing vine, six to ten feet creeping over bushes, and, with its numerous branches and wealth of brilliantly gay scarlet-purple flowers, seen at a distance presents the illusion of a grand flowering shrub, naturally suggesting it as an appropriate accessory for such a purpose in ornamental and rural adornment.

Some specimens have altogether filiform or linear leaves, and filciform subulate entire stipules; some with brighter scarlet flowers, and others purple tints abound; but they are not deemed sufficiently uniform and distinct to entitle them to varieties. Specimens presented by J. M. Hutchings, Esq., from southern California.

Dr. Kellogg exhibited specimens and made some observations on a variety of *Collomia leptalea*, Gray, from Yosemite Valley. The specimens were far more delicate than the original type, in every respect, even like the finest sewing-thread; the most peculiar feature being the disposition to twine, as occasion offers, around contiguous weeds for support. The plants, four to five inches high, have flowers of similar form and relative relations, but sky *blue* instead of *pink;* anthers spheroidal; capsule three-seeded—seeds elliptic, somewhat prismatic, subglabrous, or a little rugose, and appendiculate; the whole plant stipilate-glandular, lower leaves opposite (one to two or more pairs) filiform. As we have but two specimens, we reserve a thorough analysis rather than destroy them. Its provisional distinction might well be *filiformis*.

Mr. F. P. McLean, our promising botanical friend—late of the California University, now Johns S. Hopkins University, Baltimore—on the eve of his departure placed in our hands a specimen of *Psoralea*, ticketed "Streams of Tamelpais, 1873," which appears to be new.

Psoralea fruticosa. K.

A low-spreading sub-shrub, more or less canescent-pubescent, with shortish white soft hair throughout; leaves digitately-trifoliate, slender petioles very short (1–2 lines long), appressed; stipules subulate, strongly nerved (3–4 lines long; leaflets cuneate, oblong-obovate, recurve-apiculate, mucronate (½ to ¾-inch long, 2–3 lines broad); terminal compound spikes sessile, 2–3 inches long; the branches (mostly simple) 1–2 inches long; flowers densely crowded (50–100 or more), very small (2–3 lines), indigo blue, subsessile, or pedicels barely ½-line; persistent bracts narrowly lanceolate-acuminate about as long as the flowers; calyx teeth ovate-acute, lower tooth about one-third longer, acuminate, banner sub-obcordate cuneate into the claw, wings about equal, keel shorter; legume glabrous, ovate-oblong, acute, wrinkled and roughened. Allied to *P. floribunda* and *obtusiloba*, but readily distinguished by denser branches, foliage and flowers, branching spikes, the full-sized leaves intermixed with the flowers of the base of the spikes, and also crowding them; longer and whiter pubescence, and very much shorter petioles and pedicels, and relatively far longer stipules, and bracts; also, difference of

legume, etc. But not so readily from *P. bracteata* of the Cape of Good Hope. The upper surface of the leaves become of a dark verdigris-green in drying, like *Petalostemon macrostachya* of Torr., but all parts of the flower are most perfectly separate and distinct from the staminal sheath, as in *Psoralea.*

We are indebted to Miss Anderson for the following Lake County Lupin:

Lupinus sericatus. K.

Stem woody at the base, ascending, low ($\frac{1}{2}$ to 1 foot), pubescence white, closely appressed, as if clad in a silvery satiny sheen throughout; leaves 3–5 inches long; leaflets spatulate, extremity broadly rounded obtuse (abrupt mucronation mostly obsolete), base narrowly cuneate, $\frac{1}{3}$–$\frac{1}{2}$ the length of the petiole (or 1–1$\frac{1}{4}$ inches); racemes twice the length of the leaves (about six inches long); flowers subverticillate or scattered, purple blue; pedicels rather stout, angled, rarely as long—often shorter—than the calyx; bracts deciduous; calyx campanulate, neither gibbous nor spurred, upper lip shortly two-toothed, the scarcely longer lower lip obsoletely three-toothed; bracteoles subulate, a line or more in length: banner somewhat short, slightly pubescent on the back; wings broad, naked; keel acute, a little cilliate; pods 3-5-seeded; mature legume not seen.

The description of *Psoralea macrostachya* in the recent State Botany should be amended so as to include characteristic coast forms. In this vicinity they are weakly scabrous with elevated glands, as in the description of T. and G.; leaflets rhombic-ovate, pubescent above and subglabrous beneath; peduncles $\frac{1}{2}$–1 foot or more in length, or 2-6 times exceeding the leaves; pseudo-bracteoles of their base, sometimes developing into accessory leaves; spikes simple, or branched by twos and threes, the floral portion 2–8 inches long, cylindrical and dense, or scattered; bracts relatively broad (2 lines), or half the length of the calyx, rhombic, the abrupt acumination very short, early deciduous; calyx 4-6 lines long: lower tooth $\frac{1}{3}$ to $\frac{1}{2}$ longer, but shorter than the flowers.

Closely allied to *Phacelia cilliata*, Benth., is another form worthy of note, collected by the late Dr. Andrews:

Phacelia glandulosa. K.

Stem annual, a span or more high, with few branches at the top; hispid and stipitate-glandular, mostly throughout; leaves ovate-oblong, somewhat seven-lobed, irregularly sinuate-toothed, three-nerved, canescent-pubescent chiefly above, petioles equal, or of upper leaves shorter; spikes simple, axillary, leafy, terminal one naked, at length elongating into loose racemes, pedicels declined ascending in fruit, genitals much exserted from the blue rotate corolla; calyx lobes linear-spatulate hispid and stipitate-black glandular, and on the inside villous, $\frac{1}{2}$ to $\frac{2}{3}$ the length of the capsule; style deeply 2-parted, shorter than the bearded filaments; capsule ovate-oblong, acuminate, hispid and often glandular on the outer third, about 20-seeded; seeds triangular prismatic, minutely alveolar-pitted.

Among other observations, it is deemed important to place on record that the Hon. Vice-President, H. Edwards, presents to the Academy a naturalized

form of the true European *Bellis perennis*, found by him in Throckmorton's Cañon, growing in moist ground, near the foot of Mt. Tamelpais, in a perfectly wild state, remote from any habitation. It has been duly studied, and carefully analyzed, and is undoubtedly the plant indicated; of course, it only now sports a single series of white rays tinged at the tips with purple; is slightly reduced in size; the floret tubes proper are more hairy; stigmatic appendages not quite so broad, and rather more elongated, when compared with the cultivated plant; the first flowers are on true scapes, later flowers on very short or tufted stems; occasionally a leaf develops on the proper peduncle above the rosulate clustered foliage below.

Nemophila modesta. K.

Slender, weak and prostrate (1-1⅓ feet); leaves opposite pinnatifid, lobes 3–5, broadly lanceolate entire, sparsely hirsute above and along the veins beneath, subsessile, the narrowing base cilliate; peduncles axillary, hirsute, 3–4 inches long, or 3–5 times the leaves, erect but recurving near the capsule; calyx auriculate and increasing to age, lobes ovate, acute, hirsute; flowers large (6 to 8 lines), blue with deeper blue veins and purple spotted, hirsute within at the base, twice the length of calyx, naked (no scales, folds or ligules at the base of filaments); stamins 3 long and 2 shorter, base hirsute (anthers dark purple); style 2-parted above, hirsute below, stigmas capitate; capsules hairy, 6-seeded, seeds large and rough.

Found by Kellogg and McLean, near the Guadalupe Quicksilver Mine.

Dr. Eisen also collected specimens of a charming little annual Lupin:

Lupinus citrinus. K.

A low, slender annual, barely a span high, erect and ascending, branched from the base, hairy throughout; lower leaves long slender petioled (relatively shorter above, or from about three inches to less than an inch); leaflets linear-spatulate, attenuate at base, somewhat canaliculate, mucronate, 6–8, ¼–¾-inch long, 1–2 lines wide, stipules adnate, somewhat membranous, lance-subulate, weakly attenuate, 4–6 lines long; main raceme 4–6 inches, those of the branches 3–4, rather closely flowered from near the base (common peduncle naked below about 1 inch); pedicels short and slender; bracts linear-lance-acuminate deciduous; calyx colored, short, upper lip 2-parted, lobes acute, or subacute, lower about equal, minutely 3-toothed, bracteoles minutely obscure or wanting; flowers bright orange or golden, rounded banner dotted with a few oblong pale bluish spots near the infolded centre; wings obtuse, nearly as broad as long; keel naked; creamy-hued pod, oblong-linear, 7-lines long by 1⅓ wide, torulose, glabrous, 4-seeded, seeds rhomboid, lenticular, black blotched at the germinal end and black spotted along the ridge of the beveled margin, on a leaden ground.

Owing to the very obtuse inflated wings conforming to the general outline and size of the banner, gives the flowers somewhat the appearance of beads of gold. A charming plant for cultivation.

Dr. Eisen also brings to light a new species of *Clarkia*.

Clarkia Eiseneana. K.

Stem glabrous and glaucous, 1–1½ feet high, erect, branching above; leaves ovate-lanceolate or ovate-oblong, acute or subacute, repand-denticulate, sessile, lowest leaves subsessile or very short petioled; petals entire, lamina rhombic on a long slender claw, toothed on one side at the insertion; alternate stamens perfect, a broad densely hairy scale at the base of these filaments in front or on the inside, stigma-lobes equal, the very slender linear capsule sessile, 2–3 times as long as the obpyramidal calyx tube, hirsute together with the calyx.

Camping with Mr. Galen Clarke, he brought in the following:

Potentilla Clarkiana. K.

Stem perennial, tufted or dwarfed, and depressed ¼–1½ inches, bearing a single pair of opposite rudimentary leaves, pubescence scanty, at length glabrous; leaves ternate, leaflets nearly orbicular 4–6 lines, coarsely 5–6-toothed (if simple, 7-toothed), terminal leaflets short petiolulate; bractlets half as long as the calyx lobes, subacute; petals yellow, shorter than the calyx; about one-flowered.

Regular Meeting, September 4th, 1876.

Dr. A. B. Stout in the Chair.

Twenty-two members present.

Wm. G. Kreuger and Thos. Murffen were proposed for membership.

Donations to the Museum: From Mr. W. P. Truesdell, tarantula and nest. From W. J. Fisher and Henry Edwards, specimens of Crustaceæ. Also, ten fish from Mr. Lockington.

W. N. Lockington read the following:

Remarks on the Crustacea of the West Coast of North America, with a Catalogue of the Species in the Museum of the California Academy of Sciences.

BY W. N. LOCKINGTON.

CANCROIDEA.

Family Cancridæ. Sub-Family Cancrinæ.

No new species of this sub-family appears to have been found since Stimpson described *Cancer antennarius*.

Cancer magister. Dana. U. S. Ex. Exp., I, 151, pl. VII, fig. 1. Stimpson, Crust. and Ech. Pac. S. N. A., 18; Proc. Cal. Acad. Sci., 1, 88. *Cancer irroratus.* Randall (not Say.) Lockington, Proc. Cal. Acad. Sci., 1876.

The localities given by Stimpson for this abundant species range from Sitka to Monterey, and I have two young specimens among miscellanea, collected at Magdalena Bay, Lower California.

No. 25. San Francisco market, dried, male. W. N. Lockington.

Cancer gracilis. Dana U. S. Ex. Exp., I, 153, pl. VII, f. 2. Stimpson, Proc. Cal. Acad. Sci., I, 88; Crust. and Ech. Pac. S. N. A., 20.

The only specimens I have yet seen are those in the museum of the Cal. Acad. Sci.

No. 26. Two females, dried. Locality unknown.

Cancer productus. Randall. J. A. N. S., Phil., VIII, 116. Dana, U. S. Ex. Exp., I, 156, pl. VII, f. 3. Stimp., Proc. Cal. Acad. Sci., I, 88. *Platycarcinus productus.* Gibbes. Proc. Am. Asso., 1050. p. 177. Stimpson, Crust. and Ech. Pac. S. N. A., 21.

This species has been found at Puget Sound, Tomales Bay, S. F. Bay, San Diego, and Magdalena Bay, L. C.

No. 27. Several young specimens from Monterey, dried. Dr. J. G. Cooper.

No. 28. Young, dried. San Diego. Hy. Hemphill.

No. 40. Male, in spirits. S. F. Bay. W. N. Lockington.

Not only are the young of this species very different in appearance from the adult, but they are so variously striped and marked that a superficial examination might cause them to be considered the young of several distinct species. The specimen described by Dana was not fully grown, and, like all the immature specimens I have seen, had the teeth of the produced front low and like lobes, with a short suture on the carapax between each lobe and the next. In the adults, the teeth of the front are more separate and more acute, and the central tooth more produced than the lateral ones; moreover, the nine antero-lateral teeth are distinctly separated from each other, and the body near the antero-lateral margins is thicker than in the young.

The prevailing color of the adult is red, becoming darker and more brownish above, and orange or yellowish below. Among four young ones found under stones at Monterey, two are chocolate, with a somewhat darker tint on the elevated parts of the carapax; a third, bright yellow, with irregular blotches of dark red; and the fourth, yellow, with narrow red stripes, giving it a zebra-like appearance.

An examination of young and adult specimens only would lead to the belief that they were distinct species, but a full series of specimens, of all sizes and ages, reveals their specific identity.

This species is common in the bay of San Francisco, but I have never found either it or its young beneath the stones on the beach, as is the case at Monterey. In April of this year, half an hour's search under the stones at Preston's Point, Tomales Bay, procured me twelve fine adult specimens, all or most of them females. I did not observe any ova attached to them, and I

thought it singular that on a second visit paid to the spot in July, I could not find a single female, though at low tide mark I secured an overgrown male who had lost too many limbs to retreat with sufficient quickness.

Cancer antennarius. Stimpson. Proc. Cal. Acad. Sci., I, 88; Crust. and Ech., Pac. S. N. A., 22.

No. 29. Female, dried. Probably from San Francisco Bay. Wm. Stimpson.(?)

No. 39. Young, between tides. San Diego. Hemphill.

No. 41. Female, with ova. S. F. Bay. W. N. Lockington.

This species appears to frequent deeper water than *C. productus* or *C. magister*, as, though occasionally taken on the lines of the anglers in San Francisco bay, I have never known of its occurrence on the beach between tides. It is found on the ocean shore near Tomales, and occurs as far south as Magdalena Bay, Lower California, where a fine specimen was obtained by Mr. W. J. Fisher.

The sides of the chelipeds are beautifully marbled with dark spots upon a lighter ground in adult recent specimens.

Sub-Family Xanthinæ.

Until very lately not a single representative of this sub-family had been found upon our western shores, probably because the the first collections were made in the neighborhood of San Francisco.

The species named by Stimpson and Dana were collected at various localities from Monterey northward to Sitka, but the coast southward from the former place to Cape St. Lucas, and the shores of the Gulf of California, have been, and still are, comparatively unknown to carcinologists.

All the species of *Xanthinæ* described or mentioned in these notes have been collected in the last mentioned localities by Mr. Hy. Hemphill and Mr. W. J. Fisher.

Those species which I have previously described from single specimens furnished to the Academy by the former collector are most of them more fully known to me by numerous specimens obtained by the latter during five months spent in dredging and collecting along the uninviting shores of Lower California, while those which are new are in every case the results of the same indefatigable collector's labors.

It is somewhat singular that, so far as I am aware, not a single species of this sub-family has yet been found along the shores of Northern California, Oregon, or Washington Territory, and I cannot avoid thinking that further search may disclose some.

The genus *Panopæus* is represented on the shores of Central America by two or three forms which have not hitherto been found so far north as Lower California.

I own myself unable to perceive any sufficient reason for the separation of *Xantho* from *Xanthodes*, but I have relegated two of the narrowest forms to the latter group.

Atergatis cristatissimo. Lockington. Proc. Cal. Acad. Sci., March 20, 1876.
La Paz, San José Island, Amortiguado Bay.

This pretty little species does not appear to occur on the west coast of Lower California.

The color of the carapax in spirits is the same as in the dried specimen, viz., bright red.

No. 30. Two males, dried. From La Paz. D. E. Hungerford.

No. 42. Male and female, in spirits. W. N. Lockington.

Actæa meandricus. nov. sp.

Front four-lobed, antero-lateral margin without conspicuous teeth; postero-lateral margin highly concave.

Entire upper surface of the carapax covered with involved rugæ; those of each areolet distinct; areolets separated by sulci.

Chelipeds equal, their upper outer surface rugose like the carapax, the rugæ giving way to rows of tubercles on the underside of the manus.

Upper edge of the manus and carpus an acute angle; inner surface of both perfectly smooth; meros smooth on both sides, compressed.

Hinder limbs with compressed joints; the meros smooth on both sides, except in the fifth pair; the remaining joints rugose on their upper and posterior aspects. Meros of fifth pair rugose above. Fingers of chelipeds sulcate, short. Sternum cavernous; abdomen with transverse rugæ. Color, in spirits, dull red.

Locality, Mulege Bay, Gulf of California.

Two specimens, a male and female, are all I have seen of this well marked species.

	♂ M. M.	♀ M. M.
Greatest length	20	19
Extreme width of carapax	27	25

This little crab has a peculiarly compact appearance. The rugosities of its limbs are so arranged that when they are folded up close to the carapax not a portion of smooth surface can be seen either above or below, the only smooth portions being lateral and hidden.

Heteractæa. nov. genus.

Form of carapax as in *Actæa*, but with an external hiatus to the orbit, and its lower margin divided into two lobes. Abdomen of male, five-jointed.

I am loth to form a new genus for a species which resembles an *Actæa* so closely in its general aspect and form, which, in my belief, afford far better evidence of the real affinities of any animal than are afforded by variations in the form of the orbit or the length of the basal joint of an antenna; but I have no choice in the matter, as the genus *Actæa* is defined as "without an external hiatus to the orbit," while the genera with the lower margin of the orbit divided into teeth have a seven-jointed abdomen in the male.

Heteractæa pilosus. nov. sp.

Aspect that of an *Actæa*, but the orbit with an external hiatus, and its lower margin divided into two separate lobes. Front two-lobed, upper mar-

gin of orbit a long thick, sinuate tubercle. Teeth of front, upper and under margins of orbit, and a small tooth just external to the outer hiatus of the orbit, red, smooth, shining, and naked. The remainder of the upper surface of the carapax thickly tomentose. Antero-lateral margin with three sharp teeth projecting beyond the tomentosity. Regions of carapax distinct. Chelipeds tomentose, the carpus and manus covered with tubercles arranged in regular series on the outer side of the manus. Right cheliped larger than left; fingers sulcate. Tubercles of manus and carpus red, the red predominating at the distal end of the manus. Longer hairs scattered at intervals among the tomentosity of the carapax; hinder limbs thickly pilose.

Localities, San José Island, Amortiguado Bay; and Port Escondido, both in the Gulf of California.

Several specimens. The largest pair measure as follows:

	♂ M. M.	♀ M. M.
Greatest length	19	15
Greatest width	27	20

No. 43. Male and female, in spirits. Fisher and Lockington.

Xantho tenuidactylos. nov. sp.

Front declivous, antero-lateral margin without distinct lobes or teeth, thick; anterior portion or carapax somewhat negose, granulate; carpus and manus thickly covered with large granulations above and externally, the granulations extending on to the upper and outer surface of the fingers; fingers sulcate, those of the right cheliped (which is the larger) rather short; those of the left cheliped exceedingly long and thin. Hinder legs somewhat tomentose.

Color reddish-brown; fingers black.

One specimen only, a female, taken at low tide, on the flats at La Paz, Lower California.

	M. M.
Length of carapax	15
Width of carapax	11

Xantho grandimanus. nov. sp.

Carapax transverse, antero-lateral angles not prominent. Front four-lobed, the central emargination running back as a deep sulcus across the frontal regions of the carapax. Upper margin of orbit tumid, backed by a deep sulcus, giving off at a right angle, a sulcus separating the median from the lateral regions of the carapax. Antero-lateral teeth, five; the first two long and low; third low, but somewhat shorter; fourth much shorter and pointed; fifth very small. Areolation indistinct; frontal and antero-lateral regions granulated. Right cheliped very large, smooth, meros hollowed out throughout its posterior upper surface so as to fit closely to the under surface of the carapax; carpus large, heavy and rounded; manus broad, rounded above and without crests or tubercles; movable finger with a very large tubercle at its inner base; fixed finger with three or four tubercles. Left cheliped similar, but much smaller; fingers much smaller proportionately to the manus than

in the larger cheliped; fingers with numerous tubercles on inner surface. Hinder limbs rounded; the two last joints tomentose.

Color reddish-brown; fingers slaty.

Locality, La Paz, L. C.

The dimensions of a large specimen of each sex are as follows:

	♂ M. M.	♀ M. M.
Greatest width of carapax	71	60
Greatest length of carapax	50	41
Length of larger hand	65	50
Length of smaller hand	47	39
Greatest width of larger hand	27	22

No. 31. Male and female and young. Identity of donor unknown.

Xantho multidentatus. Lockington. Proc. Cal. Acad. Sci., Feb. 7, 1876.

No. 38. Male, dried. Mazatlan. Hy. Edwards.

PARAXANTHUS.

Xantho novem-dentatus. Lockington. Proc. Cal. Acad. Sci., Feb. 7, 1876. San Diego; San José Island, Amortiguado Bay.

Four or five specimens only. Color of carapax in spirits, whitish, with a tinge of red. and with red markings. The front is much more produced than usual in this species.

No. 32. Male, dried. San Diego. Hy. Hemphill.

All but one of the specimens from Lower California are smaller than the type specimen which was procured at San Diego, and the carapax is proportionally narrower, yet I believe them to be younger individuals of the same species, founding my belief on the prominent, narrow, entire part, curved outline of the antero-lateral margin, without perceptible angle at its junction with the postero-lateral; and on the character of the left cheliped. the fingers of which are sulcate, and devoid of prominent tubercles on their palmar surface.

Xantho spini-tuberculatus. Lockington. Santa Rosa Island, Monterey, San Diego, Magdalena Bay, San José Island.

This species appears to be of common occurrence along the coast from Monterey southward to Magdalena, but to disappear, or at least become rare, in localities further south.

Dimensions of the largest specimen:

	M. M.
Greatest length of carapax	30
Greatest width of carapax	40

The right hand in this large specimen (a male) is very much larger than the left, but this is not universally the case.

Color, in spirits: carapax greenish, with maroon cloudings; tubercles of first pair and front of carapax bright red; hinder limbs crossed by maroon bands; fingers black.

No. 33. Monterey. Dried. J. G. Cooper.

Xantho Hemphilliana. Lockington, Proc. Cal. Acad. Sci., Feb. 7th, 1876.

The only specimen I have seen of this species is the one in the possession of the Academy of Sciences, San Francisco. Some small crabs from the Gulf of California, which I at first believed to be young specimens of this form, differ in their less transverse form and more perfect areolation, and I now think them distinct, yet this can only be proved by the examination of a complete series of the Monterey form.

No. 35. Large male, dried. Monterey. Hy. Hemphill.

Xanthodes leucomanus. Lockington, Proc. Cal. Acad. Sci., Feb. 7th, 1876.

Carapax rather narrow; areolation very distinct, cardiac region circumscribed; three antero-lateral teeth (the three posterior ones) usually distinct, and directed laterally, the space usually occupied by the first two antero-lateral teeth forming an almost straight line. Basal joint of outer antennæ reaching the front; lower margin of orbit two-lobed; inner hiatus wide; front sinuate, a process meeting the basal joint of the external antennæ. Internal antennæ stout. Chelipeds sub-equal, manus broadly ovate, stouter than the carpus, smooth, shining, with a slightly raised upper edge; dactylus and pollex alike, short and stout, conical, toothed inside; furrowed. Carpus often with a roughened upper surface. Ambulatory feet almost free from setæ, but the dactyli thickly covered with very short tomentosity.

	♂ M. M.	♀ M. M.
Length of carapax	9	8
Width of carapax	11	9.5

Numerous specimens of this species were brought from La Paz, Port Escondido and Mulege Bay, Gulf of California, by W. J. Fisher. They show great variation in color, areolation, and other characters. In some the posterior portion of the carapax is much less distinctly areolated than in others; many individuals have the upper surface of the carpus, and even that of the manus, more or less rugose; some have black fingers with white tips, others have colored fingers, and the general tint of the carapax varies considerably. The original specimens from which my previous short description of this species was written, were lost in removing our collection, and I cannot, therefore, feel certain of the identity of the Gulf form with the one first described.

Xanthodes? angustus. nov. sp.

Carapax narrow, front wide, slightly sinuate; antero-lateral margin shorter than postero-lateral, three-toothed; teeth pointed forwards; the posterior margin of the hindermost teeth in a line with the postero-lateral margin. Upper margin of the orbit two-lobed, excluding the post-orbital, which is lower than the two succeeding antero-lateral teeth. Upper surface of the carapax smooth, shining, without areolation, except in the frontal region, and near the antero-lateral teeth. Chelipeds smooth, shining, without areolation, hairs or tubercles, hands rather broad, equal in size, fingers of right hand tuberculate

on the palmar surface, those of left hand with a cutting outer edge. Hinder pairs of limbs slender, slightly pilose. Color reddish brown (in spirits), chelipeds bright red.

Localities—Magdalena Bay, west coast Lower California; Mulege Bay, Port Escondido, San José Island, Gulf of California.

	M. M.
Width of carapax	14
Greatest length	10

These dimensions are from one of the largest specimens.

The *extreme* narrowness of the carapax and shortness of the antero-lateral margin make me doubtful of the propriety of placing this species in the subgenus *Xanthodes*. Its aspect is much that of a *Pilodius*, but the fingers are not spoon-shaped. There are a few scattered setæ on the two last joints of the ambulatory feet. There is considerable resemblance between this species and *X. latimanus* from San Diego, but the hands of the former are wider and the antero-lateral teeth more robust. The difference in size between the present form and the single male of *X. latimanus* in the Mus. Cal. Acad. Sci. is great, but it is not unlikely that it is either the young or a small variety of that species, but as the gulf species are in most cases distinct from those of the west coast of Lower California, I do not venture to unite them.

Xantho latimanus. Lockington, Proc. Cal. Acad. Sci., Feb. 7, 1876.

No. 34. Male, dried. San Diego. Hy. Hemphill.

Panopœus purpureus. nov. sp.

Carapax convex both longitudinally and transversely, branchial regions tumid, sulcus between gastric and cardiac regions distinct. Surface finely granulated, the granulations with a tendency to form beaded ridges. Intra-medial and extra-medial regions distinct from each other and from the antero-lateral. First two teeth of antero-lateral margin coalesced, forming a prominent bi-lobed tooth; third and fourth teeth curved forwards, the fourth shortest; fifth thick and rounded, directed forwards. Sub-hepatic spine prominent. Inferior margin of orbit three-lobed; interior lobe inconspicuous; middle lobe narrow, thick, projecting; outer lobe long, low, thin, highest on its outer angle. Outer hiatus of orbit deep and narrow. Superior margin of orbit with slight indications of a division into three lobes. Chelipeds smooth, unarmed, the right the larger; propodi and dactyli of hinder limbs beset with short bristly hairs. Color of carapax and upper surface of chelipeds bluish purple, becoming darker in the older specimens. Irregular spots and blotches of a dark brownish purple are conspicuous in the younger specimens, but become indistinct in the older, except upon the chelipeds. Fingers brown, with white tips.

	♂ *Inches.*	♀ *Inches.*
Greatest length of largest specimens	1.30	.95
Greatest width of largest specimens	1.75	1.30

Localities—Magdalena Bay, west coast Lower California; La Paz, Gulf of California. Apparently rare, as Mr. Fisher obtained but few specimens.

No. 44. Male and female. Magdalena Bay. W. J. Fisher.

Panopœus transversus? Stimpson, Am. Lyc. Nat. Hist., N. Y., vol. VII, p. 210.

Numerous specimens of a small species of *Panopœus* from Lower California do not agree at all with any of the species described by S. I. Smith, in the Proc. Boston Soc. Nat. Hist., vol. XII, Feb. 3, 1869, and from their transverse shape and the small size of the sub-hepatic spine, may probably be the *P. transversus* of Stimpson. As, however, I have no access to Stimpson's description, I think it well to subjoin a short description, as it may possibly prove to be a distinct species. Front slightly sinuate, antero-lateral teeth four, the two first long and low, the last two more pointed, with the points turned forwards. Right cheliped slightly the larger, both chelipeds smooth, shining, whitish, except on the upper surface, where the tint deepens to a reddish brown, which is the general color of the carapax. Hinder pairs of legs tomentose. Two of the largest specimens measured as follows:

	♂	♀
Length of carapax	0.65	0.56
Width of carapax	0.92	0.80

Numerous specimens were obtained in San Bartolomé and Magdalena bays, and Santa Maria Bay, all on the west coast of Lower California; also, at La Paz, Gulf of California, where it was dredged at (so far as I can make out the label, which was unfortunately torn) a depth of three fathoms. The veritable *P. transversus* was found at Corinto, Nicaragua, by J. A. McNeil (*vide* S. I. Smith, *loc. cit.*).

No. 45. Several specimens, in spirits, from Magdalena Bay. Fisher and Lockington.

Panopœus validus. S. I. Smith, Proc. Boston Soc. Nat. Hist., 1869, 273.

Panama and Acajutla. External opening of orbit broad and deep.

Panopœus Bradleyi. S. I. Smith, *loc. cit.*, 281.

Panama. External opening of orbit a deep notch rather than a groove.

Panopœus planus. S. I. Smith, *loc. cit.*, 283.

Panama. Sub-hepatic tubercle not prominent. Antero-lateral margin with four slight incisions, as in *P. transversus.*

Acanthus spino-hirsutus. Lockington, Proc. Cal. Acad. Sci., Feb. 7, 1876.

The range of this species is much more extensive than that of most of those described in the paper above referred to. The first specimen obtained was brought, with specimens of several other species, from San Diego; but whereas most San Diego forms extend down the western coast of Lower Cali-

fornia, but do not appear—judging from present knowledge—to inhabit the Gulf of California, the present species has been found in abundance at La Paz, Mulege Bay, Port Escondido and San José Island, all within the Gulf. One peculiarity of this form is the bright red tint of the prominent transverse ridge in front of the buccal area. None of the specimens I have seen from Lower California exceed in size that brought from San Diego.

No. 36. Male, dried. San Diego. Hy. Hemphill.

Menippe obtusa. Stimpson, Notes on N. Amer. Crust. (Annals Lyc. Nat. Hist., N. Y., 1858), p. 7.

Panama.

CHLORODINÆ.

No species of this group is mentioned by Stimpson, either in Crust. and Echi. Pac. Shore N. Amer., or "Notes of North American Crustacea." I have here described three species, all of which were brought from Lower California by Mr. W. J. Fisher. Although distinguished as a sub-family on account of the more or less perfect spoon-shaped tips of the dactylus and pollex of the chelipeds, the *Chlorodinæ* are so closely related to the *Xanthinæ* that it would be more natural to intercalate their genera among those of that subfamily; for instance, *Chlorodius* next to *Xantho*, and *Actœodes* next to *Actæa*.

Actœodes mexicanus. Lockington, Proc. Cal. Acad. Sci., March 20, 1876.

Mazatlan, Magdalena Bay, La Paz, where a few were dredged in thirteen fathoms; Port Escondido, Gulf of California; San José Island, Amortiguado Bay, Mulege Bay. The carapax of the largest specimen obtained measures 33 millimetres in width, and 21 in length The color ranges from dark reddish brown, sometimes tinged with green to almost white, and in some cases even the fingers are whitish. Females with ova were collected from July to August. This species is found at low tide, under stones and in coral.

No. 37. Male, dried. Mazatlan. H. Edwards.

No. 46. Male and female, in spirits. Magdalena Bay. W. J. Fisher.

Actœodes xantho. nov. sp.

Carapax broadly transverse, without teeth on antero-lateral margins or front, which slightly curve outwards in front of each areolet. Areolation complete, middle region with nine areolets. The hinder posterior areolet (2*P*. Dana) entire, long and narrow, four smaller areolets between this and the median region, and ten areolets on the antero and postero-lateral regions of each side. Chelipeds short, the meros hidden beneath the carapax, manus and carpus about equal in length, their upper surface covered with tubercles about as large as those of the carapax. All the raised portions of the carapax, and tubercles of areolets covered with granules, the sulci between tomentose. Dactyli of first pair very short, obtuse at end, the tips somewhat hollowed out, but the hollows not circumscribed within. Hinder feet short, compressed, their upper surface with elongated tubercles less distinctly granulated than

those of the carapax and chelipeds, the sulci and terminal joints tomentose. Abdomen tomentose.

	M. M.
Length of carapax..............	11.5
Width of carapax.....	18

A single specimen, female, from San José Island, Amortiguado Bay, Gulf of California. In spirits, the areolets are of a bright yellow color. There are five tubercles on the carpus, and as many on the hand. The genera *Actæa* and *Acteodes* are usually placed in separate sub-families, but the artificiality of this separation is evident to any one who compares the species belonging to the two genera. In this species, as in *A. speciosa* and *A. cavipes*, Dana, and *A. mexicanus* (*mihi*), the tips of the fingers are but imperfectly excavate, and the forms belong as truly to *Actæa* as to *Actæodes*. The two genera form, in fact, a continuous series of closely allied species.

Chlorodius Fisheri. nov. sp.

Similar in proportions to *C. sanguineus*, Edwds, but the carapax is widest between the posterior teeth of the antero-lateral margin. Front 4-lobed; a deep emargination between the long central lobes. Teeth of antero-lateral margin five in number, acute, sub-equal, and directed forwards Areolation less distinct than in *C. sanguineus*; areolets well-defined anteriorly, but not posteriorly. Pre-medial areolets joined to the extra-medial; intra-medial separated from the posterior or cardiac by a distinct sulcus; areolets of antero-lateral region six in number; postero-lateral and posterior regions without distinct areolation. Chelipeds equal, smooth, except a tooth on inner angle of carpus; all the fingers spoon-shaped, but the cavity not circumscribed within. The fingers are sulcated. Posterior legs slightly setose, claws sharp.

Color. Carapax, greenish red; chelipeds, marbled with purplish red, white beneath; fingers, black. Length of carapax of largest specimen (male), 0.78 in.; greatest width, 1.06 in.

Numerous specimens from the West coast of Lower California, collected by W. J. Fisher, also from La Paz, San José Island, Mulege Bay and Port Escondido, all in the gulf of California. It is found on the flats at low tide.

No. 47. In spirits, Magdalena Bay. W. J. Fisher.

Family ERIPHIDÆ.

27. *Ozius verreauxii*. De Saussere. Revue et Magasin de Zoölogie, V, 359, pl. XII, f. 1.

Mazatlan.

28. *Xanthodius sternberghii*. Stimpson. Notes on North American Crust. 6.

Panama.

29. *Pilumnus limosus*. S. I. Smith. Proc. Bost. Soc. Nat. Hist, XII, 286, 1869.

Panama. Peru.

30. *Eriphia squamata.* Stimpson. Notes on North American Crustacea, p. 10. (Annals Lyceum Nat. Hist., N. Y.)

Panama. Corinto, Nicaragua.

31. *Trapezia formosa.* S. I. Smith. Proc. Bost. Soc. Nat. Hist., Feb. 3 1869.

Pearl Islands, Bay of Panama, among *Pocillopora capitata*, Verrill.

32. *Trapezia cymodoce?* Guerin. Dana. U. S. Ex. Exp., p. 257, pl. XV, Fig. 5. S. I. Smith, *loc. cit.*

Locality the same as the preceding species.

33. *Quadrella nitida.* S. I. Smith. *loc. cit.*

Locality, Pacheca, one of the Pearl Islands, 6 to 8 fathoms, among pearl oysters.

When Stimpson, in 1857, published his "Crustacea and Echinodermata of the Pacific Shores of North America," not a single species of the large family *Portunidæ* had been discovered. The same naturalist in his "Notes on North American Crustacea," published in 1859, mentions one species, *Lupa bellicosa*, Sloat, MS., but gives no description, remarking that it "agrees with *L. hastata* in almost every character, except that the last two joints of the abdomen in the male are broader and more flattened."

In February of this year I described a second species, a specimen of which had been procured the preceding year at Mazatlan by Mr. Henry Edwards; and I shall in this paper describe a third, of which many individuals have been collected by Mr. W. J. Fisher at various points on the Western and Eastern shores of Lower California. At Magdalena Bay Mr. Fisher procured several very specimens of a *Lupa*, which I take to be the *L. bellicosa* of Sloat and Stimpson, but as Sloat's MS. is not on hand, and Stimpson gives no figure, my sole reason for this belief is that the other two known species from Lower California, belong to the genus *Amphitrite*, as defined by Dana.

That there may be no confusion I append a description of this *Lupa*.

Lupa bellicosa? Sloat, MS. Stimpson. Notes on N. Amer. Crust., p. 11.

Carapax regularly arched in its longitudinal and transverse directions; exceedingly wide, the post and antero-lateral outlines forming a long ellipse; no areolation except a sulcus between the median and posterior regions. Central tooth of front placed low down, between the internal antennæ, and separated by a short, somewhat pilose, space from the front proper, which has two lateral spines separated by a sinuous central portion. Upper margin of the orbit consisting of two long teeth, an ante and post-orbital; the former highest above the outer antennæ, and separated by a deep notch from the latter, which is two-lobed, the anterior lobe low, and the posterior long and pointed. Antero-lateral teeth nine, including the posterior lobe of the post-orbital, which exceeds in height any of the others except the ninth. 2d, 3d,

4th, 5th, 6th, 7th and 8th antero-lateral teeth equal, all broadly triangular. Ninth tooth much the largest, its upper ridged edge continuing across the carapax for some distance. Lower margin of the orbit pilose, rising into a conspicuous tooth immediately below the outer antennæ. Underside of carapax and sternum without hairs, except below the hinder part of the antero-lateral regions. Meros of first pair trigonal, with four sharp spines on its upper anterior edge and two blunt teeth at the distal extremity of its posterior edge. Carpus with two or three ridges exteriorly, and some short, blunt spines anteriorly. Manus with a triangular tooth next the carpus on its upper anterior edge, and also a blunt tooth at the distal extremity of its upper posterior margin. Dactyli only slightly sulcate; the teeth of the inner margins in groups of three; the central one largest. Second, third, and fourth pairs of limbs stout; the two last joints compressed and sulcate, pilose posteriorly. Fifth pair stout, without sulcations on the last two compressed joints.

Several fine specimens of this species were brought from Magdalena Bay, by Mr. W. J. Fisher.

The dimensions of a large individual, of each sex, are as follows:

	♂ M. M.	♀ M. M.
Length of carapax	6.	5.3
Greatest width of carapax	11.5	10.2
Length of right manus	7.	5.

The color is almost brown above, cream-colored below, the tubercles and ridges of the manus tinged with red.

No. 22. Male, in spirits; fine specimen. Fisher and Lockington.

Lupa dicantha. M. Edwards. Hist. Nat. des. Crust., tom. 1, p. 451. Dana. U. S. Ex. Exp., 1, 272, pl. XVI, fig. 7, T. Hale Streets. Proc. Acad. Nat. Sci., Phil., 1871, p. 239.

Amphitrite Edwardsii. Lockington. Proc. Cal. Acad., March 20, 1876.

On looking over a number of Amphitrites from Lower California, I found one only, a large female, that can be referred to this species.

It presents all the characters of the type in the Academy's museum, but in a more marked degree from its larger size. The nine spines of the antero-lateral margin are alternately large and small, the ninth no larger than the first, third, fifth, and seventh; and the points of all are black. The meros of the first pair of legs has five black-tipped spines, that nearest the carpus smaller than the central three and equal to the proximal one. The inter-orbital teeth are eight in number, and the ridges across the carapax well defined. The spines of carpus and manus agree exactly with those of the smaller specimen, previously described, and all are tipped with black.

The general color of the carapax and limbs, in spirits, is red, with lighter marblings. The tips of the fingers are black.

	M. M.
Extreme width of carapax	51
Extreme length	32
Length of movable finger	13

The upper part of the carapax is thickly tomentose, except upon the ridges. This species is well marked, and readily distinguished from the following.

No. 23. Female, dried. Mazatlan. Hy. Edwards.

Amphitrite paucispinis. Lockington.

Inter-antennal front four-lobed; pre-orbital spines slightly two-lobed. Antero-lateral spines were nearly equal in size, except the ninth, which is twice the length of the others. The outline of front portion of carapax between the last antero-lateral spines, on each side, is a regular ellipse. Posterior to the last antero-lateral spine the carapax contracts suddenly in width, so that the postero-lateral margins are L-shaped. Meros of first pair with four spines on its anterior margin, the proximal smallest. Carpus with one spine on the interior upper margin, and two on the exterior. Manus with one spine only, on its upper margin, forming the extremity of a carina. Four slightly beaded ridges on the outer side of the manus. Fingers sulcate, tubercular on the palmar margin, the movable finger with a large tubercle at the base. Second, third, and fourth pairs of limbs slender; penultimate joint of fifth pair sulcate and surrounded, as is also the last joint, with a regular fringe of hairs. Areolation of carapax very distinct; the summits of each region granulated.

The dimensions of two of the largest specimens, both female, are as follows:

	M. M.	M. M.
Extreme width from tip to tip of spines	40	54
Greatest length..	23	30

Localities—Angeles Bay, Mulege Bay, both in the Gulf of California; Magdalena Bay, West Coast Lower California.

The specimens were collected at low tide in August and September, and many of the females have the ova attached.

No. 24. Two males, dried. Magdalena Bay, West Coast Lower California. Fisher and Lockington.

Arœneus bidens. S. I. Smith. Report Peabody Acad. Sci , 1869, p. 90.

Callinectes sp? "Agrees with Ordway's *C. arcuatus.* Bost. Jour. Nat. Hist. VII, p. 578, except that there is only one distinct spine on the carpus of the chelipeds." S. I. Smith. *loc. cit.*

In my last paper upon this subject, two species of Maioid crabs mentioned in a "Catalogue of Crustacea from the Isthmus of Panama," by T. Hale Streets, was included, viz.: *Homalacantha hirsuta* (T. Hale Streets), and *Mithraculus coronatus* (Stimpson). Mr. Streets does not state on which side of the Isthmus the various species enumerated in his catalogue were collected; therefore, although I am aware that in some cases the same species occurs on both sides, I shall not in future include in this catalogue any but undoubtedly Pacific species.

Mr. Streets describes the following new species, giving Isthmus of Panama as their locality:

Mithraculus coronatus.
Aniculus longitarsis.
Cenobita intermedia.
Gebia longipollex.
Alphæus bispinosus.

The following species included in his list are Atlantic forms, some of which may possibly occur in the Pacific, also:

Mithraculus coronatus, St. . . . . Gulf of Mexico, Brazil.
Carpilius corallinus, M. Edwards . . . . Antilles.
Actæa labyrinthica, St.? . . . .
Menippe mercenaria, St . . . . Atlantic.
Lupa rubra, M. Edwards . . . . Brazil.
Ocypoda rhombea, M. Edwards . . . . Antilles, Brazil.
Uca lævis, M. Edwards . . . . Antilles, Brazil.
Hippa emerita, M. Edwards . . . . Antilles, Brazil.
Cenobita diogenes, M. Edwards . . . . Antilles.
Panulirus guttatus, Latn. M. Edwards . . . . Antilles.
" *americanus*, Lamk. M. Edwards . . . . Antilles.

The following probably reach as far north as Panama, and are therefore referred to in their order:

1. *Panopæus chilensis.*
4. *Ocypoda Gaudichaudii.*
2. *Lupa dicantha.*
3. *Eriphia gonagra.*

W. N. Lockington read the following:

Notes on Californian Fishes.

BY W. N. LOCKINGTON.

Raia batis. Linn.

Uraptera binoculata. Girard.

Dr. A. Gunther, in the Cat. Fishes Brit. Mus., Vol. VIII, p. 465, states his belief that the latter of these fishes may be regarded as a climatic variety of *R. batis.* He goes on to say that "young examples have a round obscure spot on each pectoral fin."

Had Dr. Gunther seen the fish alive, or in a fresh condition, I think that his opinion would have been different, but, as the Catalogue shows his only specimens were young, one from San Francisco, presented by Dr. W. O. Ayres, the other a skin only, presented by J. Keast Lord, from Vancouver Island.

I have myself seen specimens of large size in which the spot is as distinct as in the young, and though I cannot say I have measured them, I feel assured that one I saw in the aquarium at Woodward's Gardens about a year ago was two feet across the fins; and that the one now there is about eighteen inches.

Moreover, the eye-like spot in the centre of the pectoral is anything but obscure in the recent fish, it is most conspicuous.

But this is not all. We have in our possession a fish (caught in San Francisco Bay,) which agrees in every respect with the description of *R. batis* in the Brit. Mus. Cat.

I subjoin the dimensions—

	INCHES.
Width across pectorals	18.38
Tip of snout to centre of posterior jaw	4.12
" " anterior edge of anus	12.75
" " " " orbit	4.12
Tail to back of ventrals	8.75
Inter-orbital space (width of)	1.37
Width across ventrals	7.50

Body and fins of a uniform slaty brown color. The difference in aspect between this fish and the *Uraptera* or *Raia binoculata* is very great.

Centropomus. Sp.?

Body oblong, compressed; head contained four and a half times in the total length: outline of top of head nearly straight, slightly concave, ridges of upper surface prominent; depth increasing to origin of first dorsal, thence nearly equal to root of second dorsal, thence decreasing gently to peduncle of tail. First dorsal with eight spines—the first minute; the second about one-sixth the length of the third; third, longest, very stout; fourth, fifth, sixth and seventh rapidly decreasing; eighth, prostrate. Pectorals small, extending to little more than the half length of the ventrals, which exceed them in size. First spine of anal very small; second, long and stout; third, slender, but slightly the longest. The orbit is slightly elliptical. Lower jaw protruding beyond the upper; maxillary, when the mouth is closed, extending to a perpendicular from the centre of the pupil. Teeth nominal. Pre-operculum strongly serrated. Color, when fresh, back to lateral line dark green, becoming lighter below, and whitish on the belly. Snout, green, yellow on the sides. Iris, golden. Pectorals, lead-color, with green centre; ventrals, the same. Caudal, lead-color in centre, with green margins. Dorsal, green, with bluish stripe, and tipped with golden. Fin-formula, D. $8 \mid \frac{1}{10}$; A. $\frac{3}{6}$. Branchiostegals, 7. The following are the principal dimensions of the specimen presented:

	Ft.	*In.*
Total length, from tip of lower jaw to end of tail	1	5.5
Length of head, from tip of upper jaw		3.88
Tip of snout to origin of first dorsal		5.5

Origin of first dorsal to origin of second dorsal	3.35
Length of third dorsal spine	2.25
Length of base of first dorsal	2.75
Length of base of first anal	1.5
Eye to tip of snout	1.3
Circumference at origin of spinous dorsal	7.5
Width of inter-orbital space	0.63

The single specimen was taken by Mr. W. J. Fisher, off Asuncion Island, Lower California, at a depth of eight fathoms.

The proportions and coloration of this fish agree very nearly with those of *Centropomus undecimalis*, Cuv. and Val ; and I strongly suspect its identity with that species, which is, however, not known to me from specimens or figures.

C. undecimalis is a native of the Atlantic shores of tropical America; but Dr. Gunther queries its occurrence at Lima. If it should prove, on further acquaintance, to be a distinct species, I propose to name it *Centropomus viridis*.

Dr. Kellogg submitted the following:

On some New Species of Californian Plants.

BY DR. A. KELLOGG.

Dr. G. Eisen's specimens of *Carpenteria Californica* in full flower enable us to record some further items of interest. In these the flowers are pure white, fragrant, 2–2½ in expansion; bracteoles ovate, acute, instead of "subulate," only ¼ inch below the flower, and as the central peduncle has none, under high culture, it is fair to presume these would prove only reduced normal leafy bracts; the petioles are connate at base, often shortly sheathing. The flattened cymosely-pannicled masses of flowers show it to be a more compact bloomer than our *Philadelphus* species, which it so much resembles; the intermixture of buds with the open flowers also indicate a lengthened period of bloom. This must prove a most valuable ornamental acquisition.

In Dr. Eisen's collection we also find a new species of Blazing Star, or *Mentzelia crocea.* K.

Annual (?) stem branching two feet or more high, bark white, ashy puberulent and scabrous, hirsute with rather long white simple hairs above, leaves oblong, pinnatifid, lobed, upper ovate-lanceolate, acuminate, sessile, sinuate-pinnatifid or toothed; flowers axillary and terminal; subtending bracts ovate-acuminate, coarsely toothed or sub-lobed. (1–2 on each side.)

Capsule, slender, clavate or gradually enlarging above to the truncate top; sessile, hirsute, an inch or more long; immature seeds, flat. Calyx segments ovate-lance-acuminate—half the length of the stamens, or about ⅓–¼ the petals; hairs on the back from conspicuous elevated gland-like bases; petals, five, oval or oval-oblong, abruptly short-acuminate, golden satiny yellow, on a very short saffron-colored claw; flowers large (2–2½ inches across); stamens

very numerous, free, golden filaments, with the lower third deep saffron-hued, oblong anthers, spirally twisted, like short sections of fine cord; style exserted, simple, or altogether undivided. A very beautiful saffron-eyed species; hence the specific name.

Vice-President Edwards, seeing it stated in the Cal. Bot. that the *Aralea Californica* "had not been collected in mature fruit," brought a specimen for record. The berries are deep purple, pulpy, symmetrically smooth, and round as the largest shot, or very slightly oblate-spheroid, shortest diameter the axis, consisting of five oblong, semi-oval, compressed seeds, somewhat bluntly margined on the outer more curved edge. The ripe fruit is apt to fall away, or, if retained, is so crushed that the color, form and character to an extent is lost, which may account for the remark.

In Dr. Eisen's collection is a small form of *Madia glomerata*, var. *eglandulosa*, K., worthy of note. Stem simple, 5-6 inches high, cymosely clustered at the top, hirsute throughout, without glands; lower leaves opposite, rarely alternate except above first and second pairs, subspatulate to linear, acute, obscurely three-nerved, base cilliate, subsessile to sessile; heads turbinate, rays 7-9, yellow, three-lobed or deeply three-toothed; disk florets, 7-10, tubes naked, pappus of five or more long plumose awns, receptacle convex, fimbrillate, pitted.

Among Dr. G. Eisen's prairie collection, Fresno County, is an exceedingly minute plant, which ought to belong to *Heterocodon*, although, as at present characterized, it is quite at variance.

Heterocodon minimum. K.

Stem filiform, ½-1 inch high, simple or branching from the base, more or less hirsute throughout; leaves alternate, general outline broadly fan-shaped, three-lobed (save 1-2 of the lowermost round or oval, entire or crenate, often opposite), principal leaves also subdivided into 2-3 lobules, or deeply cleft-toothed, the middle larger lobe broadly cuneate, three-cleft-lobed, the lateral lobes into mostly two lobules; petioles about as long as the lamina, upper-bractoid leaves becoming cuneate fan-form 5-3-two-cleft-lobules, including the confluent stipules, and subsessile to sessile; stipules large adnate to the petiole, stem-sheathing, entire, or 1-3 coarse teeth on each side; flowers axillary, or becoming so, 2-4 from the axils of each leaf, pedicels unequal, about ½-1 line long, calyx superior (?), herbaceous lobes 3-4, subulate, entire, about as long as the spheroidal tube or capsule; flowers none (hitherto seen); the globose capsule densely hirsute, somewhat constricted at the origin of the calyx segments, which are tipped like the lobules or teeth of leaves and stipules by a long spinulose hair, one-seeded (more?), seed glabrous, pyriform. Rarely a leaf is seen somewhat pinnatifid; those tiny plants are found flowering and fruiting only three-lines high.

Another almost microscopic plant of the prairies of Fresno, collected by Dr. Eisen, is a new

Stylocline acaule. K.

Stemless heads sessile on the root crown in the earth, rarely upon it; size of whole plant, ¼–⅛ inch (range of fifty specimens); leaves spatulate, oblong lamina, acute, tipped with a black gland or callous, white-woolly, narrow, petiole expanding towards the base; outer scales and seeds as in the generic description; the five inner more rigid ligneous involucrate series of scales surrounding the sterile flower, narrower, acute, woolly on the inner face, glabrous outside; the single floret purple tipped; neither pappus nor setiform hairs.

Also among Dr. Eisen's collection we find the matured fruit of a beautiful evergreen shrub, 3–5 feet high, the fruit of which has been hitherto unknown, on which we offer a passing remark. In this specimen of *Leucothœ Davisæ*, Torr., the somewhat erect raceme from the final axils of the leaves is solitary (the embryo buds at the base, however, show that under favorable auspices it would be clustered); the pendulous flowers become somewhat erect at maturity; the lower bracts of the base are short, rounded-cordate, cinnamon brown; the bracteoles above more oblong, acute; the pedicels have also one or two bractlets a little below the calyx, persistent; at length, as the fruit matures, become more or less deciduous; these are ovate acute; capsule depressed, globose; valves thin, dry, chartaceous, almost translucent, subangled and celled, opening loculicidally, each cell 1–2 seeds maturing out of about 12 ovules; seed oblong-ovoid, slightly a little curved, rugose-pitted.

Among Dr. Eisen's plants we find a form of what we take for *Gilia achilleafolia*, var., wherein the stem is very scabrous, and scabrous glandular heads, base, and the leaves, at their axils, woolly; the leaves 2–3 inches long, loosely pectinate-pinnatifid, linear lobes in 3–6 pairs, ⅛–1½ inches long (rarely a lobe subdivided); sparsely hirsute, petioles ½–1 inch long, woolly ciliate; flowers smaller, stamens exserted; style shorter, and stigmas simple, etc.

Sierra Nevada, at 4,000 feet.

Among a package labeled "Vicinity of San Francisco," is a novel species of *Prosartes*. Stem, 1–1½ feet high, pubescent, two branched; leaves, 2–2½ inches long, 1–2 inches broad, subabruptly, acuminate, somewhat obliquely cordate, closely clasping, pubescent, margin finely ciliate (scarcely scabrulose?). Perianth unequal, green or foliaceous, obscurely nerved, base acute; sepals, 2–3 lines long (rarely 4 lines), 1–2 lines broad—the two outer being the largest—outermost, and largest of all, ovate, or obovate, subacute; opposite sepal oblong, subobtuse, the very short base slightly narrowed—the three inner narrower; sepals lanceolate (all more or less obscurely nerved). Stamens scarcely a little unequal exsert. Anthers linear-oblong, slightly enlarged at base, saggetate, glabrous, 1⅛–2 lines long, filaments somewhat unequal, short, style glabrous, simple. Fruit not known.

Among Dr. Eisen's Fresno plants is *Bœria platycarpha*, Gray. Flowering in March. This shows some latitude of variation from the received description worthy of a passing note. In plants of equal stature the parts are reduced in number; *e. g.*, the involucral scales are only five, instead of 6–7; awns of pappus, 3–4, instead of 7–8; leaves remotely laciniate toothed, three-nerved, reticulate veined, etc.

Among Dr. G. Eisen's Fresno collection is a marsh herb of the *Gratiola*-like group, although quite at variance with the 2-fertile stamened genera and species, with transverse, confluent, or united roundish, or even saggetate anthers; besides, in this plant they are not approximated, nor is the style simple, lips of stigma flattened, etc. The peculiar features, therefore, necessitate generic recognition, whatever may be best deemed their ultimate destination.

Ranapalus. K.

Calyx 5-parted, unequal in size, about equal in length, outer three broadest; crolla bell-funnel form, tube short, throat ventricose with a sub-rotate border, glabrous within, about equally 5-lobed, segments flat, somewhat lipped—½ upper larger (?)—cleft or deeply emarginate; lower three more spreading; stamens four, all fertile, subdidynamous, erect, distant, subexserted, nearly equal; anthers of two distinct elliptical cells, vertically parallel, fixed by the middle to a flattened subulate simple filament; style straight or scarcely a little curved, nearly as long as the stamens, about equally 2-lobed, stigmas capitate, crenated or toothed (rarely again subdivided); capsule inclosed chiefly by the two largest segments of the calyx, 4-valved, completely 2-celled by the free placenta; seeds covering the whole surface. Generic name from *rana* (frog), *palus* (swamp), its habitat, to indicate its North American representation of the South American genus *Ranaria*, with which it is almost identical.

Ranapalus Eisenii. K.

Roots, fibrous; stem, a span high, dichotomously much branched from the base, lateral branches often prostrate, sarmentaceous, not articulated, compressed, 3-nerved, more or less pubescent, or subglabrous below, almost hirsute above; leaves opposite, sessile, obovate, obtuse to obovate-oblong, often a little oblique, slightly narrowing at the broad base, glabrous, sparsely dotted, fleshy, entire, about 5–10-nerved; peduncles axillary, solitary (or 1–2), compressed, pubescent, about as long as the leaves, ¼–¾-inch long, 1-flowered. The color of the flower creamy white, chrome yellow shaded throat and tube, indigo blue anthers; capsule ovate-oblong, acute, many seeded, inserted over the broad surface of the placental partition, chiefly along the longitudinal double dark central band of each cell; seeds linear-oblong, slightly narrowing to the base, rough, cinnamon brown, scarcely appendiculate, and very obscurely margined. Flowers, 4–5-lines across, and about the same in length.

The resignation of Theo. A. Blake as Corresponding Secretary, was read and accepted, and the appointment of his successor referred to the Council.

Mr. Harford exhibited curious samples of wool, growing first black, then white, then black again—not colored artificially. Presented by B. P. Flint & Co.

Regular Meeting, September 18th, 1876.

Dr. A. B. Stout in the Chair.

Sixteen members present.

Among donations to library were five volumes, presented by Alfred A. Pinaut. Dr. Stout read the translation of the titles: "Library of American Linguistics and Ethnography" (3 volumes); "Voyages to the Northwest Coast of America," Part I—The Cavern of Aknañh, Island of Ounga, Alaska.

A special vote of thanks was passed to Mr. Pinaut for his valuable contribution.

Botanical Papers.

BY DR. A. KELLOGG.

In Dr. G. Eisen's collection is a small and slender Asteroid, which in general appearance suggests some forms of *Polygonun tenue* or *P. avicularæ*. Stem purple at the base and insertion of the leaves, otherwise grassy green.

Aster tenue. K.

Stem perennial, ½–1 foot high, slightly flexuous, erect, glabrous, compound racemose-panniculate with short, rather closely erect branches, few flowered; flowers very small, 3–4 lines broad; leaves 1–3 inches long, 1–4 lines broad, lower, short, spatulate, mostly entire; higher cauline lanceolate-linear, narrowing into 3-nerved winged petioles, one inch long or less, base half-clasping, minute corneously denticulate remotely above the middle, lamina firm, glabrous, translucently reticulate veined, margins scabrous; size diminishing above into sessile ovate-oblong lance-subulate, near the base of the obconic involucre; scales of the involucre loosely imbricated in 4–5 series, the outer shorter, rigid, green, scarious, entire margins, linear, lance-pointed, violet-tipped apex corneously subulate, often recurve-hooked, inner and inmost, linear, longer, scarious, sharply acute, rays pistillate, rose-red, 20–30 or more in a single row, very minute, slightly exsert beyond the pappus, fertile; disk florets few, about five, filiform tube gradually enlarging to the 5-toothed pinkish border; branches of the style short, subulate, scarcely a little clavate towards the acute apex; akens linear-oblong, slightly compressed, apparently nerveless, very minutely appressed, pubescent—of the rays, slightly narrowed above and below—of the disk, diminishing from the somewhat truncate top to base; receptacle minute, rather deeply alveolate.

Among Dr. Eisen's collection is a *Rannunculus* quite distinct from *R. Californicus*, Butte, although allied; also from *R. Nelsoni*, var. *tenells*, Gray. The leaves in this, not being pennately ternate, nor any tendency to a trifoliate character, but are continuously trifid, and of like features consistently throughout, to the least bracteoles, where it vanishes.

Rannunculus. Eisenii.

Stem slender, one foot high, base somewhat ascending, thence erect, panniculately branching, glabrous, or subglabrous below, sparsely pubescent above; radicle leaves on very long slender petioles, 6–8 inches, 3-parted, segments cuneate, nerved, trifid, the lobes often again cut-toothed, glabrous, or very obscurely a little pubescent, in general outline broadly fan-shaped with a subcuneate base; cauline leaves of like form, on petioles 1½-½ inch long, or sessile at the top and at length, the bractoid ones either lobed or filiform linear; the slender peduncles 1–3 inches long, somewhat pubescent; sepals yellow, ovate-oblong, acute, slightly pubescent, strongly reflexed, shorter than the petals, oblong-subobovate; flowers about 6-lines broad; akenes smooth, scarcely a line long, a little flattened, edges from sharp becoming somewhat obtusely rounded, beak strong, short and recurved; heads compact globular, 2-lines in diameter.

Scutellaria Bolanderi, Gray., in Dr. A. G. Eisen's collection, have ovate leaves, or perhaps ovate-oblong, and all are essentially on petioles, 3-1-line long, in 1-2 of the topmost pairs (out of twenty-five pairs) only subsessile—all distinctly serrate, with coarse truncate teeth below the upper third.

Clematis ligusticifolia has from 4–6 or 8 sepals, top of the climber pubescent, leaves 2–6 inches long (petioles) of 3-pairs and odd leaflet, the lower pair again ternate, pubescent beneath and on the margins; genitals scarcely half as long as the sepals (exceptional?); outer filaments widely flattened or petaloid.

In *specularia biflora*, Gray, Dr. Eisen's specimens exhibit some features worthy of note. Stems ascending, branching from the base, angled, short reflexed; strigose or strigulose-hispid along the angles, chiefly below, only scabrulose backwards above; lower leaves obovate obtuse, more or less decurrent into petioles ¼-inch long, or about half the length of the lamina to very short, and so sessile to clasping (3-6 inches above the base); flowers 1–3 in the axils; otherwise as described.

Dr. Burleigh presented to the Academy's Herbarium a small *Gentiana*, of the stipitate group, closely allied to *G. glauca*, from St. Paul's Island, Alaska, but as in the description of that species no notice is taken of the denticulate lobes of the flowers, etc., we furnish the following description:

Gentiana glauca, var. *Paulense*.

Stem ½-2 inches high, erect or ascending, often branched from the base; perennial root of creeping and thickened fibres; lower leaves obovate-cuneate, decurrent into short-winged petioles, above ovate sessile, about ½-inch long, ¼-inch wide, fleshy, smooth on the margin, 3-nerved and reticulated base, con-

nate and short-sheathing, approximated or crowded, the final leaves colored, bracted and involucrate to the terminal fascicle of 3–6 flowers, besides a few axillary and solitary below. The calyx is tubular-campanulate 4-lines long, upper portion somewhat inflated, membranaceous, colored (blue, like the flowers); teeth unequal, about ¼–⅓, the tube somewhat triangular, base thence acute, smaller segments linear-lance subulate; corolla tubular, slightly inflated above the calyx, but again a little constricted at the throat, lobes five, very short, ¼–⅓ the flower, ovate, subacute, margins minutely denticulate, beardless within, infolded and entire at the simses, ½–¾-inch long, 2-lines broad; filaments from half a line becoming 4–6-lines long, anthers saggitate oblong acute; ovary elliptical, as long as the stipe; seeds minute, scarcely oblong, rough, very obscurely wing-girded.

Description of three New Species of Sessile-Eyed Crustacea, with remarks on Ligia occidentalis.

BY W. G. W. HARFORD.

Ligia occidentalis. Dana.

In some alcoholic miscellanea sent from Magdalena Bay, L. C., by Mr. W. J. Fisher, we found thirty to forty individuals of the above species, which agree sufficiently well with Prof. Dana's description of *L. occidentalis* to be readily referred to it, although some points of difference between our specimens and the Professor's definition of that species, may be of interest.

According to Dana's description, the number of joints in the flagellum of the outer antenna is from 16 to 18. I have counted the joints in the flagella of six individuals, with the following result: 28, 26, 28, 24, 24, 28. The specimens from Lower California do not clearly show the coloration often so conspicuous in individuals of the same species found on the shores of our bay, yet it is evident upon a close examination. The irregular black dots on the limbs of this species are very constant, and in form suggest Arabic characters.

Dexamine scitulus, n. sp.

Upper antenna longest, the short third joint of its peduncle extending to the middle of the third joint of the lower. Second joint of the lower antenna about one-third longer than the corresponding joint of the upper. Flagellum of lower antenna ciliate on lower side. Eyes small and indistinct. First gnathopoda weak, hand of second obovate, carpus slightly produced inferiorly with a bundle of setæ on the same edge. Telson single.

Length, 1 inch.

Dredged in six fathoms Magdalena Bay, Lower California, by Mr. W. J. Fisher. My description is made from a single specimen. It is the most beautiful amphipod I have yet met with, and when first taken from the water must have been a most attractive object. Color light purple, with deeper dottings of the same color on the epimera. I regret that more of this inter-

esting species were not received, that I could have furnished the Academy a good series.

Idotæa marmorata, n. sp.

Body rather slender; outer antenna about half the length of the body; fifth joint nearly equal to the united length of the third and fourth. The posterior margin of the cephalon and the anterior margin of second segment, dorsally contiguous. Four first segments of the pereion equal, and about one-third longer than either of the following. The emarginated caudal shield is longer than the four preceding segments.

Length, $\frac{11}{16}$.

I place the above species in the genus *Idotæa*, in which Milne Edwards includes *Stenosomæ* and *Siduræ*, of Leach, and the *Leptosomæ*, *Hebe*, *Oliskæ*, *Zenobiæ*, and *Armidæ*, of Risso. Our specimen possesses the long antenna and somewhat slender form of *Stenosomæ*. The suture between the first and second segments of the pleon is just discernible at the lateral outline only, no trace of it being visible when viewing the caudal plate from above. Our specimen was collected and sent to us by Mr. W. J. Fisher, from the west coast of Lower California. It is a very pretty species, its marbled coloration suggesting the specific name we have given it.

Idotæa muricata, n. sp.

Outline elliptical. First four segments of the pereion equal, the last three decreasing gradually; each segment traversed by a transverse dorsal ridge, bearing three muricoid spines, between which and the lateral margin of each segment are from four to six small tubercles. Abdomen rapidly narrowed to an obtuse, horn-like point. Eyes prominent. Antenna not seen.

Length. $\frac{7}{16}$ in.

The species above described was obtained by Mr. W. J. Fisher, from Icy Cape, about three years ago. Its very rough dorsal surface clearly distinguishes it from all other members of the genus with which we are acquainted; in fact, it differs so greatly from all species of *Idotæa* we have hitherto seen, that we were inclined to form a new genus for its reception; but as no less than seven genera are included in *Idotæa* by M. Edwards (and subsequently by Bate and Westwood), of some of which we have not seen the descriptions, we have placed it as above. Our single specimen is without antenna, they having been broken off in transit.

The eyes are prominent, and in advance and above each is an irregular shaped and apparently hollow spine, posterior to the frontal outline of the head, at a distance equal to their heighth. The cephalon, like the body, possesses the same rough tuberculose character.

The Secretary read the introduction of a paper "On the Determination of the Constant g," communicated through the Corresponding Secretary by E. Dyer.

Thomas Guerin spoke of the cost and weight of conduit pipe, and suggested, that, as there was so much difference of opinion among inquirers with reference to the subject, a discussion would be serviceable at a future meeting.

The appointment, by the Council, of Dr. A. B. Stout as Corresponding Secretary for the unexpired term of Theodore A. Blake (resigned) was announced.

REGULAR MEETING, OCTOBER 2D, 1876.

Vice-President Hyde in the Chair.

The Chairman stated that a communication had been received from the Society of California Pioneers, inviting the Academy to attend the funeral of James Lick.

The following gentlemen were appointed pall-bearers on behalf of the Academy: Henry Edwards, Henry C. Hyde, Charles G. Yale, C. D. Gibbes, C. Troyer and S P. Christy.

Mr. R. E. C. Stearns addressed the Academy as follows:

MEMBERS OF THE ACADEMY: It is customary, in societies like this, upon the death of a member, to formally announce the fact and to record the same in the proceedings.

In pursuance of this formality, it has been assigned to me to tell you what you have already heard, and what half the world has already learned through the telegraph and the printing press, that JAMES LICK, our friend and benefactor, has passed away. He died peacefully at one o'clock yesterday (Sunday) morning, October 1st, at the advanced age of eighty years.

It is eminently proper that we should speak in praiseful language of the dead, for, aside from a general feeling of gratitude for his munificent benefactions, which would justify our eulogy, he was one of the earliest members of the Academy, and always

expressed the most friendly interest in its affairs, a warm appreciation of its objects, as well as a generous sympathy for those who were unselfishly working to build up a scientific organization, and to advance the cause of science on the western shores of our country.

Though not educated in those higher schools where the mind is trained to scientific study and thought, his native breadth of mind was nevertheless quick to perceive the lofty aims and grand successes of Science, and the many blessings she has conferred upon mankind.

If we examine into the character of his numerous gifts and the objects he designed to subserve thereby, we find that he acted consistently and in perfect harmony with the sentiment I have indicated, and which governed him in the division and varied dispensation of his exceeding wealth.

Whatever may have been his idiosyncracies, his varying moods of temper, his mind was clear and logical as to how or in what manner his fortune could be best apportioned, and it was bestowed thoughtfully and in pursuance of long cherished convictions. He loved his country, and the sentiment of patriotism incited him to dedicate a portion of his means to the perpetuation, by a monument, of the memory of the author of "The Star Spangled Banner." He was proud of his adopted State and city, hence his gift for a group of statuary illustrative of the settlement and growth of California. He was, during a portion of his life a mechanic, hence the endowment for a school of instruction in the mechanical arts and his gift to the Mechanics' Institute. Himself one of the earliest settlers in the State, he cherished the Society of California Pioneers, and made it and them participants in his bounty. With a high regard for Science and a warm friendship for our Society, he remembered the dubious days in its history; he was familiar with our embarrassments, and not unmindful of our poverty; he had witnessed our "struggle for existence," and gave us with a generous hand.

So, to the University of California, in which he has endowed an Astronomical Department, which is to bear his name, with a princely gift of the value of nearly three quarters of a million of dollars. And so on through the long list of his benefactions we find maturity of design, and a sagacity in the selection of

beneficiaries, which indicate a clear head and an enlarged and generous purpose. A great writer has said:

> "The evil which men do lives after them;
> The good is oft interred with their bones."

This is no unmeaning platitude, but it can be said in truth that it does not apply to him of whom we are speaking.

It may be said by some that our late member, in the bestowal of his gifts, was governed by a common weakness, the desire to perpetuate his name. Concede this, and what then? Is this unnatural, or is this an exceptional case? It is safe to say that the world will readily forgive a vanity which exhibits so noble a form of expression. It is equally safe to assert that the name of JAMES LICK deserves and will receive an honorable place on the roll of great public benefactors; and that those who succeed us in the affairs of this Academy, and who will be especially benefited by the means and facilities for scientific research through the considerate bounty of JAMES LICK, and who will thereby be enabled to contribute something to "the sum of human knowledge," will ever hold his name in grateful remembrance.

The following resolutions, offered by Mr. Stearns, were adopted:

Resolved, That the members of the California Academy of Sciences have learned of the death of their fellow member, friend and benefactor, JAMES LICK, and will ever hold his name in grateful remembrance.

Resolved, That the Academy of Sciences accepts the invitation of the Society of California Pioneers, and will attend the funeral in a body; and it is further

Resolved, That a suitable record of the death of JAMES LICK be entered in the minutes and published in the proceedings, and that the Academy do now adjourn, without transacting further business.

In Memory of

James Lick.

Regular Meeting, October 16th, 1876.

Dr. Blake in the Chair.

Donations to the Museum: From C. F. Kirchner, specimen of silver ore; from G. A. Treadwell, variegated copper ore, from Mexico; from Dr. J. L. Ord, three specimens of Monterey marble; from C. D. Gibbes, specimens of coal, gypsum, conglomerate, terra alba, gum demar, catechu and chrome iron; from Henry Edwards, specimen of serpentine; from J. W. Glass, two specimens of quartz containing asbestos, also specimen of cat's-eye; from Wm. McGillwray, Indian mortar and pestle from Big Panoche Valley; from R. H. Stretch, a cabinet containing about 600 specimens of minerals.

A special vote of thanks was given to Mr. Stretch for his fine donation.

Pacific Coast Lepidoptera.—No. 18. Description of a New Species of Heterocampa (Larva and Imago).

BY HENRY EDWARDS.

The following interesting species was detected by me in the fall of last year, feeding upon willows, in the neighborhood of Mt. Shasta, making the second of the genus now known to inhabit California:

Heterocampa salicis, n. sp. Hy. Edwards.

Larva, *Mature*. Ground color, bright golden yellow with subdorsal, longitudinal bands of clear white. Head, bright vermillion red, rather small, grooved in centre, with a small fovea in front. Second, third, and fourth segments, with broken black lines, those on the sides occasionally edged with white, each segment with two long spinous tubercles. Fifth segment, bright vermillion red, much swollen dorsally, and bearing eight spinous tubercles. The remaining segments are all striped longitudinally with slightly waved black lines, broken up on the sides into a series of dots. Anal segment, with ten warty spinous tubercles, without white, and all the lines obsolete. Feet and legs, yellow, spotted with black. Mouth parts, black. Spiracles, very small, black. Each of the warty tubercles is furnished with a single dirty white hair.

Length, 1.25 inch.

Six caterpillars taken, all feeding close together, upon a dwarf willow, their brilliant colors giving to the plant at a little distance the appearance of a raceme of showy flowers. In a few days they began to undergo their change, and by the 27th of August had all transformed. The cocoon is formed of very close, fine, glossy silk, the leaves of the plant being drawn around it so as to conceal it entirely. It is almost egg-shaped, and very symmetrical.

Chrysalis. Short, broad, bright, chestnut brown, very glossy and shining, the abdominal portion showing the few hairs of the larval tubercles.

Length, 0.65 inch.

The perfect insects began to appear on the 22d of December, a second followed on the 9th of January, and the third on the 16th of March. The remaining specimens all died in the chrysalis state.

Imago. Head and thorax, clothed with dense iron gray hairs, the latter towards the base changing into rich chestnut brown, mottled with fawn-color. Abdomen, stone drab, paler at the base, with the anal tuft fawn-color. Antennæ, with the shaft stone drab, the pectinations yellowish brown.

Primaries. Pale fawn-color, densely clothed with white scales, scattered somewhat irregularly, thickest towards the costal edge, and there forming an imperfect streak. Inner margins, darker, and with rich brown blotches, continued faintly to the posterior angle. At the base of the wings is also a conspicuous, somewhat saggitate patch of the same rich brown color. Fringes, white, mottled with brown. Secondaries, whitish drab, with brown markings near the anterior margin, and a brown blotch near the anal angle.

Underside. Dull whitish drab, shading into brown on the costal edge of both wings. Fringes of primaries, mottled with brown; of secondaries, pure white.

Expanse of wings, 1.55 inch.

This species differs considerably from its congener (*Het. conspecta*, Hy. Edw., Proc. Cal. Ac. Sci., Sept., 1874) in its more irregular markings, in the absence of any defined bands or spots, and in the darker base of the primaries. Both species appear to be rare, and are as yet known only by the specimens in my collection.

Dr. James Blake read the following paper on

Remedy for the Phylloxera.

My attention having been directed some months ago to this new pest which so seriously threatens the destruction of our vineyards, a series of experiments was undertaken under my direction at one of our largest vineyards in Sonoma County, with the view of discovering some means of checking the progress of the disease, as it has already almost destroyed some of the most promising vineyards in that locality. At the time of commencing my investigations I was aware that the subject had occupied the attention of some of the most distinguished scientists in France for the last three or four years, nor should

I have entered on the investigations with any hope of success had I not known that the efforts of these gentlemen seem to have been directed to the destruction of the insect without having acquired sufficient knowledge of its natural history. So far as known, the insect is one which goes through a series of generations without changing its form, during which many thousands of insects can be produced from a single impregnated ovum (75,000,000 have been calculated), but after a certain number of these parthenogenic generations of the power of non-sexual reproduction ceases, and the development of a new form becomes necessary for the continuation of the species. This alternation of generations takes place in many of the lower tribes of animals; the different generations of the same animal being in some instances so dissimilar as to have been mistaken for different species. In the phylloxera the forms usually met with, or, at least, that had been described when I commenced my investigations, were two non-sexual forms, the nymphs and nurses, the former being a small insect with legs which allow a certain degree of locomotion, the latter being a form in which the legs are so slightly developed as to be hardly visible, so that the insect can move but a very short distance from the spot where the ovum is deposited. Besides these two non-sexual forms, whose life is entirely subterranean, there is a winged form in which the two sexes are developed, and which passes the greater part of its existence above ground. Within the last few months it has been discovered that this winged insect deposits its eggs on the leaves and bark of the vine, and from these eggs it is probable that a new generation of nurses and nymphs arises which, at least for many generations, propagate themselves on the roots of the vine without any males being produced. There were two important questions relating to this winged form of the insect which had not been decided—namely, whether they deposit any eggs on the root or bark of the vine under ground, and the form of the insect that is first produced from the impregnated ovum. These questions have an important bearing on the means to be taken for the destruction of the insect, but unfortunately neither of them had received a satisfactory answer. In the spring of this year I presented some specimens at the Microscopical Society, of a form of the insect that had not been described. In my frequent examination of the roots of diseased vines during the winter, the insect was only met with under the form of nurses, which remained in a dormant state from the beginning of November to April. The first sign of a renewal of activity in the insect was the appearance of a form much resembling the nymph but rather larger, with a sort of gelatinous body, and so transparent that from ten to twenty ova could readily be distinguished in the abdomen. It was much more active than the nymphs, running about the roots with agility. My own opinion is, that it was a form of insect directly developed from the impregnated ovum, but whether it had been hatched above the ground and had traveled down on the root, or whether any impregnated eggs had been deposited beneath the surface from which it had been produced, is not known. The same form of insect was described by Mr. Balbiani at a meeting of Academie des Sciences at Paris, about two weeks after I had exhibited it at the Microscopical Society. On seeing this form of the insect, the idea at once struck me that this was the phase of its existence in which it could

most readily be destroyed, and believing that this form was one which was necessary for the continuation of the species, its destruction would necessarily be followed by the disappearance of all the other forms.

The bisulphide of carbon seemed to present the only agent likely to be efficacious against the insect. Owing to the extreme volatility of this substance, its vapor, when it is introduced at some distance beneath the surface, would permeate the earth in all directions over a considerable area, and thus would have a chance of reaching even the distant rootlets of the vine. Although it had been reported in France that the substance was not destructive to the insect, yet I believed that the soft, apparently nude form, which I had just discovered, would not resist it. In order to introduce the substance beneath the ground, an iron tube was taken with a sharp steel point at one end, the sides being pierced with a few small holes near the bottom, and a piston was made which could be forced down the tube. The tube was driven into the earth for a distance of one or two feet, near the root of the vine; some bisulphide of carbon was poured into the tube, which was then filled with water, and the contents of the tube forced out into the ground with the piston. The tube was then drawn out and the hole filled up. The quantity used on each vine was about an ounce and a half of the bisulphide. This was introduced into the ground through two or three holes. The substance was applied in the end of April and early part of May, only one application being made, and in every instance to plants that were evidently suffering from the disease. The result has been, on the vines so treated the insect has almost entirely disappeared, while on vines that were in the same condition last year as those to which the bisulphide had been applied, but which were not treated, the roots swarm with the insect, so that none of them are likely to survive this season, at least of those that were most affected. In the early part of the season no great difference was noticed between the foliage of the vines that had been treated and the others, but within the last six weeks the vines on which the insect had been destroyed present a decidedly healthier appearance. A more marked difference is observable in the roots, specimens of which I submit for inspection. It will be seen that while the roots of the vines to which the bisulphide has been applied present a comparatively smooth and healthy appearance, the roots of the untreated vines are rough and covered with dead and decaying bark. In both sets of roots the lower portion is generally dead, the result of the ravages of the insect during the last season; but while in the plants which are still infested with the insect this process is still going on and will continue until the vine is destroyed, the other roots are throwing out quite a number of healthy rootlets and are covered with a new and smooth bark, so that they will be prepared in the ensuing year to throw out a new crop of rootlets.

As regards the practicability of the treatment this presents no obstacle, as the bisulphide of carbon can be obtained now in a comparatively pure state at fifty cents per pound; and I am confident it can be produced in a form quite suitable for use in the vineyard at a third of the price, so that the cost of the material for each vine would not exceed two or three cents. The process of applying it is simple, and can be carried out by any ordinary laborer. The

time for applying it should be during the month of April, as at this season the insects that have survived the winter have not begun to lay their eggs, and experiments that have been carried on during the summer show that while the bisulphide is a certain poison to the insect in all its forms it does not destroy the egg. This is the reason of its reported failure in France, where probably it was not applied at the right season. By using it in the spring, at the time that the winter eggs at the surface are being hatched and before the hybernating form has commenced laying, we have the insect entirely in that phase of its existence in which it can be killed by the bisulphide; and experience has shown that at this time its destruction is completed by one application of the poison. The only place where the insect has been found on some few of the vines treated has been near the surface, where the vapor became too much diluted with the air to prove fatal, and one patch of the insect was found at a depth of more than four feet, where it was possible the vapor had not penetrated. In the course of my experiments I have discovered that the refuse lime from the gas works will kill the insect for some distance beneath the surface when it has been applied round the roots, and from what we know of the natural history of the insect it is almost certain that it will shortly die out at any great depth, when it cannot be renewed by fresh nymphs developed from the winter ova. The plan of treatment I have advised for the diseased vines is, during the winter, and as late as possible before the cessation of the rains, to apply three or four pounds of the lime refuse round the stem, drawing the earth away from the stem to the depth of two or three inches, at the same time brushing the stem for six or eight inches above the ground with train oil. Then about the middle of April to the first week in May use the bisulphide of carbon under ground in the way I have pointed out, making three holes round each vine at a distance of eighteen inches from the stem, and using about two-thirds of an ounce to each hole, the holes when the tube is withdrawn being well filled with earth and stamped down.

When the vine is so far diseased as to have suffered materially in its foliage, the better plan is, I think, to pull it up. But a careful examination will detect the presence of the insect on the roots of vines the foliage of which appears quite healthy and which are bearing a full crop of fruit. In this stage of the disease the insect is not in sufficient numbers to so completely absorb the descending sap as to have prevented the formation of new rootlets, and while this is the case the vine can readily recover itself. Whatever may be the case in other countries, I am convinced that here the destruction of the lower portion of the roots is not caused by the direct attack of the insect, as I have found the roots dead two or three feet beyond where any traces of the insect could be discovered. Owing to the peculiarities of our climate, the vines send their roots much deeper here than in Europe, and although in the older vines in the vineyard where I investigated the disease the roots derived their principal supply of nourishment at depths from six to ten feet, I have not found the phylloxera at a greater depth than four feet, although the roots were dead as far as they could be traced, and far beyond any part that had been directly attacked by the insect. Where the vines are pretty badly diseased, I think the application of the bisulphide at the beginning of the winter,

say in November, would more than repay the expense, as thousands of insects would be thus destroyed that otherwise would be feeding on the juices of the vine during the next five months. This, however, must not supersede the use of the poison in the spring at the time when the winter eggs are developed.

In the roots shown this evening the healthy appearance of the new rootlets on the treated vines is a sufficient proof of the absence of the phylloxera, although I would state that after a careful examination I have not detected a single insect. The roots that were not treated have not thrown out a single rootlet. It is needless to remark that the vines that were treated all showed evidences of being attacked by the disease last season, as is evident from the appearance of the roots, although not an insect is to be found on them at present.

Where the vines have not been already attacked, I believe the application of train oil to the stem and the gas works lime to the surface round the top of the root will protect them, or a small quantity of the bisulphide introduced near the root a few inches beneath the surface in the spring, would certainly save them from the attack of the insect.

Mr. Guerin read a paper on the Factor of Safety in Water Pipes.

Regular Meeting, November 3d, 1876.

Dr. Stout in the Chair.

Ten members present.

L. A. Scowden was proposed for resident membership.

Donations to the Museum: From W. J. Fisher, specimens of *centropomus*, trachynotus pampanus, octopus, 22 birds and 110 shells; from J. M. Dore, specimen of echeneus maceatus; from Henry Edwards, two fish—one mineral and slab containing fossil; from John Torrence, California gopher.

The President transmitted to the Academy a short paper, dated October 12th, upon the recent search for Vulcan. LeVerrier's telegraphic dispatch asked observers upon the Pacific Coast to make search for Vulcan on the 9th and 10th of October. Professor Davidson was then stationed at the U. S. Coast Survey trigonometrical station, Mt. Helena, at an elevation of 4343 feet above the sea, and had been systematically observing the sun for sun spots and planet from the 6th of October. On the 9th and 10th the disc of the sun was very carefully and frequently examined with a good telescope of three inches aperture and a magnifying power of 85, adjusted for the determination of position of any object on the Sun's surface. Especial care was given to the afternoon hours when the sun was below the horizon to the eastern observatories. Late in the afternoon of the 10th two small spots were discovered, and from their size and want of definiteness it is safe to say that any well defined dark object having a diameter of ten seconds of arc would have been readily detected.

Professor Davidson states that his examination of the sun's disc before the request of LeVerrier was made known, arose from tentative studies which he had been making upon the action of Mercury, Venus, Earth and Jupiter, (together with a probable intra-mercurial planet,) upon the fluid surface of the sun in not only changing its form and causing solar spots, but in the almost infinitesimal reactionary effect of the very slightly distorted form upon the planets, and especially upon the yet unexplained variation of the earth's rotational velocity, which he surmises may have a period of about forty years.

A description of a fish caught at Port Madison, W. T., was submitted by Ferdinand Westdahl, through Prof. Geo. Davidson.

Pacific Coast Lepidoptera.—No. 19. Notes on a Singular Variety of the Larva of Halesidota Agassizii. Packd.

BY HENRY EDWARDS.

It has generally been conceded by entomologists that variation of certain characters in either of the stages of insect life, so long as that variation is contained within what has been called the "well defined limits of a species," does not constitute a ground for founding new species upon trivial differences. But *remarkable* changes in the larvæ of certain forms are decidedly the groundwork upon which other ideas may arise, and are the beacons which light us to a better understanding of the laws which govern the many developments of animal life, which, with their almost countless variations, lead us to the conclusion that our positive knowledge of what really constitutes a species is very limited in extent, and compel us to the confession that we can say but little as to where a species is true to its original type, or how far its wanderings may extend. It is a singular fact that the genus *Halesidota* should present two kindred instances of the variation of the larval stage to such an extent as almost to warrant the assumption that new species had in these cases begun to assert their existence; but it is nevertheless so, the one to which I am about to refer being even more remarkable than that spoken of by the late Mr. B. D. Walsh, in Proc. Boston Soc. Nat. Hist., Feb., 1864, and further alluded to by him in the Proc. Ent. Soc., Phil., Nov., of the same year. To those who are not familiar with Mr. Walsh's papers, it may be briefly stated that he found feeding upon oak some larvæ of this genus, differing very much, both in color and in the arrangement of the pencils of hairs, from those of the well known Atlantic species, *H. tesselaris*, but which, upon arriving at their perfect state, could not possiby be distinguished from the imagos of that species. Mr. Walsh, regarding the larval condition as of equal value with the subsequently matured form, called his new discovery by the name of *H. Antiphola*, and always referred to it as a phytophagic species, and not a phytophagic variety. Mr. Grote, on the other hand, in Proc. Ent. Soc., Phil., December, 1864, alludes somewhat slightingly to Mr. Walsh's experiments, and considers the *Antiphola* of the latter author as merely an accidental variety of the better known and more abundant form; and this, it is but fair to say, is the conclusion arrived at by most other entomologists. It gives me great pleasure to be able to add some few facts bearing upon this interesting question, and to present the description of some larvæ, which, at the time of their capture, certainly appeared to me to be those of a totally new and undescribed species, but which, in their imago condition, can in no possible character be distinguished from the well known California species, *H. Agassizii* of Packard,=*Phægoptera salicis*, Bois. My specimens were taken by myself in August, 1865, in Strawberry Valley, near Mount Shasta, one of them feeding upon alder (*Alnus viridis*), and the other upon a species of willow. For the better comparison of the singular

differences in the larvæ, I subjoin, in parallel columns, the description of both:

Hal. Agassizii.

Head, body and prolegs, entirely black. Abdominal legs, dirty yellow. Body, slightly depressed, with the three anterior and three posterior segments evenly clothed with velvety black hairs, out of which spring some pencils of white hairs, much longer than the general clothing of the body. The middle segments are clothed with very bright lemon yellow hairs, with a black lozenge-shaped patch in the middle of each segment. In some specimens the yellow extends further, both anteriorly and posteriorly, the black hairs being consequently less; but there is little or no change during the growth of the larva, save in size, the colors being quite similar through the successive moults.

Hal. Agassizii. Var. *Alni.* Hy. Edw.

Color of body, cream white, except the head, which is jet black. Bundles of hair of the same form and arrangement as in *H. Agassizii*, but wholly of a beautiful cream white, concolorous with the body of the caterpillar. Down the middle of the dorsal region, is a row of oblong, bright red, almost vermillion, lozenge shaped bundles of hair, wanting on first, second, third and anal segments.

Length, 1.00 inch.

Previous to the last moult, the caterpillars became very dull in color, and the subsequent condition was seen through the larval skin prior to its exclusion. The appearance then presented was much closer to the usual form of *H. Agassizii*, but with a few striking differences. The body was now wholly slate black. Head, jet black, shining. Mouth parts, black, with a streak of cream color above them. 2d, 3d, 4th, 5th, 9th, 10th, 11th, 12th and 13th segments, as in *H. Agassizii*, clothed with jet black hairs, with long white pencils interspersed. The middle segments, that is, the 6th, 7th and 8th, are bright golden, and not lemon yellow, without any black hairs whatever. Thoracic legs, black; abdominal, dull yellow.

It will thus be seen that the great difference of these larval forms consists in the stages previous to the last moult, the typical one being then lemon yellow, with black extremities, and black dorsal hairs, while the other is cream white, with vermillion dorsal hairs. Moreover, the last moult of my new variety is apparently specifically different from the normal form, the yellow being a much deeper and richer tint, and the black bunches of dorsal hairs being utterly wanting. It may be well to state that *H. Agassizii* feeds exclusively upon willows, whereas my Shasta examples thrived equally upon willow and alder.

They were found on the 17th of August, changed from the white and red stage on the 26th, and spun their cocoons on the 14th and 16th of September. In this condition there was no appreciable difference, except that the golden hairs gave rather a richer appearance to the cocoon. The moths emerged on the 1st and the 15th of March, both being females, and presenting, as I have said, no points of distinction from the ordinary coloring and markings of the typical species. For the sake of reference, I propose for this variety the name of *Hal. Alni.*

Regular Meeting, November 20th, 1876.

Vice-President Edwards in the Chair.

Nineteen members present.

Donations to the Museum: From G. A. Treadwell, specimen of inetacinnatarite, Lake County, Cal.; from Henry Edwarus, silver ore and fossils from White Pine, Nev.; from C. D. Gibbes, stamp copper and fine copper, Penabic mine, Michigan; fossil shells, Fresno County, Cal.; sandstone and infusorial earth from same place; petroleum from Gibbes' oil spring, with samples of burning and lubricating oils, Fresno County; asphaltum from naptha oil springs, Kern County, Cal.; from G. Yale Gay, lussite, from Soda Lake, Churchill County, Nev., also manufactured product; from C. L. Scudder, Arizona rubies; from Mrs. Elizabeth Bush, San José, 40 specimens of copper ore, 20 specimens sulphuret of iron, and sulphurets of zinc, from Buchanan copper mine, Fresno County, Cal.; 20 specimens andaluriate crystals from near Buchanan mine; 23 specimens crystals of calcite anceforsil shells, from Penitensia Cañon, Santa Clara County, Cal.; three specimens rock from Black Spring, Penitencia Cañon; three specimens of sandstone; two specimens of conglomerate, containing andalusite crystal; 13 crystals (California diamonds), Lake County, Cal.; fibre of milk weed, Fresno County; one pine and two spruce cones from Glen Falls, N. Y.; from Asa T. Hayden, Honolulu, land shells and fresh-water shrimps from the inormtum streams.

Mr. Lockington described a species of lizard from Lower California.

Dr. Kellogg read the following paper:

On a recent visit to Mendocino County, Mr. Joseph H. Clarke, our corresponding member and enterprising collector and contributor in several departments of natural history, gave some plants, and among them is found a new species of *Isopyrum*, which it is proposed to name in his honor.

Isopyrum Clarkii. K.

Stem simple, filiform, glabrous—rarely more than one—1–3 inches high, 1-flowered; root, a fasiculus of oblong sessile tuberlets; leaves biternate, radicle leaf on a long slender petiole, the leaf or leaves about equaling the stem, rarely exceeding it. Cauline relatively shorter, stipules minute, petiolules very short, leaflets broadly obconic, 2–3 cleft lobed segments oblong, obtuse, mucronate, base cuneate, about 2–3 lines long and 1 broad, somewhat glaucous beneath; flowers on long filiform terminal peduncles, white, 4-lines in diameter; sepals oblong-obovate, subobtuse; stamens 9–10, filaments lance-linear, flattened, somewhat petaloid—not dilated above—two-thirds the length of sepals; folicular ovaries 5–6, oblong, flattened, about 3-seeded, on stipes one-third their length. Differs from *I. occidentale* in its size and simple 1-flowered character, pods stipitate, 3–4 seeded, and more distinctly separate stipules; the roots also are not the thickened fibres of that species, but true ablong little tubers. Growing among mosses.

The following plant of Mr. W. J. Fisher's collection at San Diego, is so rare—if not altogether new—it is proposed to make it known provisionally as a variety of Dr. Gray's.

Actinolepis mutica. var.

Stem erect, simple, oppositely branching above into a loose somewhat corymbose spreading top, canescently villous, with short glandular hairs throughout, more or less mixed with long simple hairs above; leaves opposite (upper sessile), 1–2 inches long, pinnatifid, filiform, or narrowly linear lobes from a somewhat broadened rachis, or margined petiole, rather palmately multifid as reduced on the branches; peduncles slender, 2–3 times the length of the leaves or 1–2 inches long, solitary and terminal, a few from the upper axils, involucre broadly bell-shaped, scales about 12, or same number as the rays, acute tips hispid and glandular somewhat recurved, loosely appressed carinated to the middle; rays longer than the scales; akenes linear-cuneate, black, minutely scabrulose, of the ray incurved; pappus very minute, about 5–8, obtuse, laciniated membranous or hyaline scales; receptacle sharply conic finely pappillose-pubescent; disk florets yellow, glandular, tips of the teeth bearded on the back and nerves each side of the sinuses often produced into minute spines; branches of the style tipped by a short naked cone.

C. D. Gibbes read a paper describing the geological formation of the oil region in Tulare Valley, west of Tulare Lake, exhibiting also specimens of the oils and rocks.

A paper was submitted, through Dr. Kellogg, by Prof. G. Eisen, entitled, "A preliminary report on the Lithobre of North America."

Lithobioidæ Americæ Borealis.

Preliminary Report on the Lithobii of North America.

BY ANTON STUXBERG.

The oldest account, as far as I know, of the occurrence of Lithobii in North America is dated about fifty years ago, when Thomas Say, in the year 1821, in his "Descriptions of the Myriapoda of the United States," (Journal of the Academy of Natural Sciences of Philadelphia, 1st series, vol. 2, pp. 102–114) described a species found in the vicinity of Philadelphia, under the name of *Lithobius spinipes*.

Next to Say comes George Newport, who (1845) in his classical work "Monograph of the class Myriapoda, order chilopoda," (Transactions of the Linnean Society, vol. XIX, pp. 265—302, 349—439,) described as being found in the United States, three species: *Lithobius multidentatus*, *L. Americanus* and *L. planus;* of these Newport considers, however, not without some doubt, *L. Americanus* to be identical with *L. spinipes*--Say; and according to my opinion this same *L. Americanus* is no other species than the one in Europe so exceedingly common, and well known since the time of Linneus, as *L. forficatus* (Linneus), not to mention a very short communication by Perbosc in Revue Zoölogique, 1839, page 261, where a supposed new species *L. Mexicanus* is very unsatisfactorily described.

When Ludwig Koch, in the year 1862, published his monographic treatise on the genus Lithobius (Die Myriapodengattung Lithobius, Nümberg, 1862,) he also described as new two North American species: *L. transmarinus* and *L. mordax*.

Shortly afterwards, 1863, we find by Horatio C. Wood, Jr., under the title: "On the chilopoda of North America, with a catalogue of all the specimens in the collection of the Smithsonian Institution," (Journal of the Academy of Natural Sciences of Philadelphia, new series, vol. V, pp. 5–52,) the beginning of a monograph of the myriopods of North America. Of Lithobii he enumerates not less than seven species: *L. multidentatus*, *L. Americanus*, *L. paucidens*, *L. planus*, *L. nobilis*, *L. Xanti*, and *L. bipunctatus*, of which the three last mentioned are arranged under a separate Genus *Bothropolys*, distinguished from the old genus *Lithobius* Leach, by the arrangement of pori coxales in several more or less irregular rows.

In his principal work of somewhat later date, (1865), "The Myriapoda of N. America," (Transactions of the American Philosophical Society, new

series, vol. XIII, pp. 137-248,) he however, after continued study and with access to the necessary material, somewhat modified his former ideas of the N. American Lithobii, as can be seen by a comparison between the species mentioned in his two different works of the years 1865 and 1863.

(Genus LITHOBIUS, WOOD.)

1865.		1863.
L. Americanus	=	*L. multidentatus.* *L. Americanus.*
L. transmarinus.		
L. mordax.		
L. paucidens	≠	*L. paucidens.*
L. planus	=	*L. planus.*

(Genus BOTHROPOLYS, WOOD.)

B. multidentatus	=	*B. nobilis.*
B. Xanti	=	*B. Xanti.*
B. bipunctatus	=	*B. bipunctatus.*

Two years later or in 1867, we find mentioned also by Wood another species *L. bilabiatus*, from Illinois, "Notes on a collection of California Myriapoda, with the description of new eastern species," (Proced. Acad. Nat. Science of Philada. 1867, pp. 127-130.)

Finally, during the last years, the following species of Lithobii not previously known have been added to our knowledge of the myriapod fauna of North America:

(*a.*) Of Alois Furnbert and H. de Saussure, 1869, ("Myriapoda Nord Americana." Revue et Magasin de Zoologie, 2:me série, vol. XXI, pp. 149-159.) *L. aztecus*, *L. mystecus* and *L. toltecus*, all from Mexico.

(*b.*) Of Fr. Meinert, 1872, ("Myriapoda Musei tranniengis, II Lithobiini:" Nat. Tidsskrift, 3:R., 8:Bind, pp. 281-344) *L. vorax*, from Louisiana.

(*c.*) Of O. Harger, 1872, ("Descriptions of New N. American Myriopods:" Am. Journal of Sc. and Art, 3d series, vol. IV, pp. 117-121,) *L. pinetorum*, from Oregon; and lastly

(*d.*) By the author of this paper, 1875 ("Nya N. Americanska Lithobier" —Ofvers. Kgl. Vet. Acad., Fish. aig 32 pp., 65-72). *L. monticola*, *L. pusio*, *L. paradoxus*, *L. obesus*, *L. kochii*, *L. megaloporus*, *L. eucnemis*, *L. saussurei* and *Lamyctes fulvicornis*.

Such is, in short, the historical development of our knowledge of the Lithobii of the N. American continent. Their number—very small, certainly, in comparison with what is known from Europe—does not exceed twenty-four, considering *L. spinipes*, Say, to be identical with *L. americanus*, Newport. The following is an abstract from a more extensive work, now in preparation, a preliminary report with synonymy of all hitherto known species.

Of the following species I know personally fourteen, or 2, 3, 5, 7, 8, 10, 13, 14, 16, 18, 19, 20, 21, 24. A very rich material, carefully collected and pre-

served, has been remitted to me by Gustaf Eisen, now in San Francisco; but besides I have also had the opportunity to receive valuable contributions from H. de Saussure in Geneva, and Fr. Meinert in Copenhagen.

Gen. I. LITHOBIUS Leach 1815. (Trans. Linn. Society, vol. XI, p. 381.)
Subgen. I. EULITHOBIUS Stuxberg 1875. (Ofvers Kgl. Vet.-Akad:ns Förhandl., arg. 32 N:o 3 pag. 8.)

Santa Sorsualia, 6, 7, 9, 11, 13 *angulis porticis productis.*
Poricoxales in pedum paribus 12, 13, 14, 15.

1. EULITHOBIUS MULTIDENTATUS Newport 1845.

Syn. 1845. *Lithobius multidentatus* Newport, Trans. Linn. Society, vol. XIX, pag. 365.
1847. " " Gervais, Hist. Nat. d. Insectes Aptères, vol. IV, pag. 236.
1856. " " Newport, Catalogue of the Myriapoda, pag. 17.
1863. *Bothropolys nobilis* Wood, Journ. Acad. Nat. Sci. Philadelphia, new series, vol. V, pag. 15.
1865. " *multidentatus* Wood, Transact. Americ. Philos. Society, new series, vol. XIII, pag. 152.

Hab. in civitatibus orientalibus, ex. gr. Pennsylvania, Illinois, Missouri (sec. Wood).

Subgen. I. NEOLITHOBIUS Stuxberg 1875. (l. c., pag. 8.)

Scuta dorsualia, 7, 9, 11, 13 *angulis posticis productis.*
Pori coxales in pedum paribus, 12, 13, 14, 15.

2. NEOLITHOBIUS vorax Meinert 1872.

Syn. 1872. *Lithobius vorax* Meinert, Naturhist. Tidsskrift, 3:dje Række 8:de Bind, pag. 292.

Hab. in Louisiana circa Beloxi haud procul ab New Orleans (sec. Meinert).

3. NEOLITHOBIUS mordax L. Koch 1862.

Syn. 1862. *Lithobius mordax* L. Koch, Die Myriapodengattung Lithobius, pag. 34.
1872. " " Meinert, Naturhist, Tidsskrift, 3:dje Række, 8:de Bind, pag. 294.

Hab. circa New Orleans (sec. Koch et Meinert).

4. NEOLITHOBIUS TRANSMARINUS L. Koch 1862.

Syn. 1862. *Lithobius transmarinus* L. Koch, Die Myriapodengattung Lithobius, pag. 33.

Hab. circa New Orleans (sec. Koch).

Subgen. III. LITHOBIUS [Leach] Stuxberg 1875. (Ofvers Kgl. Vet.-Akad:ns Förhandl., årg. 32 N:o 3, pag. 8.)

Scuta dorsualia 9, 11, 13, *angulis posticis productis.*
Pori coxales in pedum paribus 12, 13, 14, 15.

5. LITHOBIUS XANTI Wood 1863.

Syn. 1863. *Lithobius Xanti* Wood, Journ. Acad. Nat. Sci. Philadelphia, new series, vol. V, pag. 15.
1872. " *rugosus* Meinert, Naturhist, Tidsskrift, 3:dje Række, 8:de Bind, pag. 306.

Hab. in California, Oregon, cet.

6. LITHOBIUS PLANUS Newport 1845.

Syn. 1845. *Lithobius planus* Newport, Transact. Linn. Society, vol. XIX, pag. 366.
1847. " " Gervais, Hist. Nat. des Insectes Aptères, vol. IV, pag. 236.
1856. " " Newport, Catalogue of the Myriapoda, pag. 18.
1863. " " Wood, Journ. Acad. Nat. Sci. Philadelphia, new series, vol. V, pag. 14.
1865. " " Wood, Transact. Americ. Philosophical Society, new series, vol. XIII, pag. 151.

Hab.—?

7. LITHOBIUS SAUSSUREI Stuxberg 1875.

Syn. 1875. *Lithobius Saussurei* Stuxberg, Ofvers Kgl. Vet.-Akad:ns Förhandl., årg. 32 N:o 2, pag. 71.

Hab. in Mexico (H. de Saussure).

8. LITHOBIUS FORFICATUS Linné 1758.

Syn. 1758. *Scolopendra forficata* Linné, Syst. Nat., ed. X, vol. I, pag. 638.
1778. " " De Geer, Mém. p. servir à l'hist. des Insectes, vol. VII, pag. 557, tab. 25, figg. 1–6.
1815. *Lithobius forficatus* Leach, Transact. Linn. Society, vol. XI, pag. –
1815. " *vulgaris* Leach, Ibidem, pag. 382.
1815. " *lævilabrum* Leach, Ibidem, pag. 382.
1821. " *spinipes* Say, Journ. Acad. Nat. Sci. Philadelphia, vol. II, pag. 108.
1842. " " Lucas, Hist. Nat. d. Crust., d. Arachn. et d. Myriapodes, pag. 543.
1844. " *forficatus* C. Koch, Deutschl. Crust., Myriap. und Arachniden, Heft 40, tab. 20.
1845. " *americanus* Newport, Trans. Linn. Society, vol. XIX. pag. 365, tab. XXXIII, fig. 29.
1845. " *forficatus* Newport, Ibidem, pag. 367.
1845. " *Leachii* Newport, Ibidem, pag. 368.
1847. " *forcipatus* Gervais, Hist. Nat. d. Insectes Aptères, vol. IV, pag 229.
1847. " *americanus* Gervais, Ibidem, pag. 236.
1856. " " Newport, Catalogue of the Myriapoda, pag. 17.

Syn. 1856. " *forficatus* Newport, Ibidem, pag. 18.
1856. " *Leachii* Newport, Ibidem, pag. 19.
1862. " *forficatus* L. Koch, Die Myriapodengattung Lithobius, pag. 39.
1862. " *hortensis* L. Koch, Ibidem, pag. 45.
1862. " *coriaceus* L. Koch, Ibidem, pag. 51.
1863. " *forficatus* C. Koch, Die Myriapoden, Bd. I, pag. 113; tab. 52, fig. 104.
1863. " *multidentatus* Wood, Journ. Acad. Nat. Sci. Philadelphia, new series, vol. V, pag. 13.
1863. " *americanus* Wood, Ibidem, pag. 14.
1865. " " Wood, Trans. Americ. Philos. Society, new series, vol. XIII, pag. 148.
1866. " *forficatus* Palmberg, Sveriges Myriapoder Ordn. Chilopoda, pag. 15.
1866. " *hortensis* Palmberg, Ibidem, pag. 17.
1868. " *curtirostris* Eisen & Stuxberg, Ofvers. Kgl. Vet.-Akad:ns Förhandl., årg. 25, pag. 376.
1869. " *forficatus* Meinert, Naturhist, Tidsskrift, 3:dje Række 8:de Bind, pag. 259.
1869. " *coriaceus* Meinert, Ibidem, pag. 260.
1869. " " v. Porath, Ofvers. Kongl. Vet.-Akad:ns Förhandl., årg. 26, pag. 637.
1871. " *forficatus* Stuxberg, arg. 28, pag. 496.
1872. " " Meinert, Naturhist, Tidsskrift, 3:dje Række, 8:de Bind, pag. 315.

Hab. in civitatibus orientalibus, ex. gr. New Foundland (J. Lindahl), New York (G. Eisen), Canada, Illinois, Missouri, Arkansas (sec. Wood).

9. Lithobius Aztecus Humb. and Saussure 1869.

Syn. 1869. *Lithobius aztecus* Humb. and Saussure, Revue et Magazin de Zoologie, 2:me série, vol. XXI, pag. 156.

Hab. in Mexico (sec. Saussure).

10. Lithobius Mystecus Humb. and Saussure 1869.

Syn. 1869. *Lithobius Mystecus* Humb. and Saussure, Revue et Magasin de Zoologie, 2:me série, vol. XXI, pag. 156.

Hab. in Mexico (sec. Saussure).

11. Lithobius paucidens Wood 1863.

Syn. 1863. *Lithobius paucidens* Wood, Journ. Acad. Nat. Sci. Philadelphia, new series, vol. V, pag. 14.
1865. " " Wood, Transact. Americ. Philosoph. Society, new series, vol. XIII, pag 151.

Hab. in California circa Fort Tejon (sec. Wood).

12. Lithobius pinetorum Harger 1872.

Syn. 1872. *Lithobius pinetorum* Harger, Americ. Journal of Science and Arts, 3:rd series, vol. IV, pag. 118.

Hab. in Oregon, "in the valley of the John Day River" (sec. Harger).

Subgen. IV. PSEUDOLITHOBIUS Stuxberg 1875. (Ofvers. Kgl. Vet.-Akad:ns Förhandl., arg. 32, N:o 3, pag. 8.)

Scuta dorsualia 9, 11, 13, *angulis posticis productis.*

Pori coxales in pedum paribus 12, 13, 14, 15.

13. PSEUDOLITHOBIUS MEGALOPORUS Stuxberg 1875.

Syn. 1875. *Lithobius megaloporus* Stuxberg, Ofvers. Kongl. Vet.-Akad:ns Förhandl., arg. 32, N:o 2, pag. 69.

Hab. in California ad San Francisco (G. Eisen).

Subgen. V. HEMILITHOBIUS Stuxberg 1875. (Ofvers. Kgl. Vet. Akad:ns Förhandl., arg. 32, N:o 3, pag. 8.)

Scuta dorsualia 11, 13, *angulis posticis productis.*

Pori coxales in pedum paribus 12, 13, 14, 15.

14. HEMILITHOBIUS EUCNEMIS Stuxberg 1875.

Syn. 1875. *Lithobius eucnemis* Stuxberg, Ofvers. Kgl. Vet.-Akad:ns Förhandl., arg. 32, N:o 3, pag. 14.

Hab. in civitate New York ad Mount Lebanon (G. Eisen).

Subgen. VI. ARCHILITHOBIUS Stuxberg 1875. (Ofvers. Kgl. Vet.-Akad:ns Förhandl., arg. 32, N:o 3, pag. 8.)

Scuta dorsualia omnia angulis posticis rotundalus vel subrectis.

Pori coxales in pedum paribus 12, 13, 14, 15.

15. ARCHILITHOBIUS BIPUNCTATUS Wood 1863.

Syn. 1863. *Bothropolys bipunctatus* Wood, Journ. Acad. Nat. Sci. Philadelphia, new series, vol. V, pag. 16.

1865. " " Wood, Transact. Americ. Philosoph. Society, new series, vol. XIII, pag. 153.

Hab. in California cet. trans Rocky Mountains (sec. Wood).

16. ARCHILITHOBIUS MONTICOLA Stuxberg 1875.

Syn. 1875. *Lithobius monticola* Stuxberg, Ofvers. Kgl. Vet.-Akad:ns Förhandl., arg. 32, N:o 3, pag. 14.

Hab. in Sierra Nevada (G. Eisen).

17. ARCHILITHOBIUS TOLTECUS Humb. and Saussure 1869.

Syn. 1869. *Lithobius Toltecus* Humb. and Saussure, Revue et Magasin de Zoologie, 2:me série, vol. XIX, pag. 157.

Hab. in Mexico (sec. Saussure).

18. ARCHILITHOBIUS PUSIO Stuxberg 1875.

Syn. 1875. *Lithobius pusio* Stuxberg, Ofvers. Kongl. Vet.-Akad:ns Föhandl., arg. 32, N:o 3, pag. 16.

Hab. in California ad San Francisco (G. Eisen).

19. ARCHILITHOBIUS KOCHII Stuxberg 1875.

Syn. 1875. *Lithobius Kochii* Stuxberg, Ofvers. Kongl. Vet.-Akad:ns Förhandl., arg. 32, N:o 3, pag. 18.

Hab. in California ad Sauzalito haud procul ab San Francisco (G. Eisen).

20. ARCHILITHOBIUS OBESUS Stuxberg 1875.

Syn. 1875. *Lithobius obesus* Stuxberg, Ofvers. Kongl. Vet.-Akad:ns Förhandl., arg. 32, N:o 2, pag. 67.

Hab. in California ad Sauzalito (G. Eisen).

21. ARCHILITHOBIUS PARADOXUS Stuxberg 1875.

Syn. 1875. *Lithobius paradoxus* Stuxberg, Ofvers. Kongl. Vet.-Akad:ns Förhandl., arg. 32, N:o 2, pag. 67.

Hab. in California circa urbem San Pedro (G. Eisen).

22. ARCHILITHOBIUS BILABIATUS Wood 1867.

Syn. 1867. *Lithobius bilabiatus* Wood, Proceed. Acad Nat. Sci. Philadelphia, 1867, pag. 130.

Hab. in Illinois (sec. Wood).

[Species incertæ sedis:]

23. LITHOBIUS MEXICANUS Perbosc 1839.

Syn. 1839. *Lithobius mexicanus* Perbosc, Revue Zoologique 1839, pag. 261.

Hab. in Mexico (sec. Perbosc).

Gen. II. LAMYCTES Meinert 1869. (Naturhist. Tidsskrift, 3:dje Række, 5:te Bind, pag. 266.)

24. LAMYCTES FULVICORNIS Meinert 1869.

Syn. 1869. *Lamyctes fulvicornis* Meinert, l. c. pag. 267.

1869. *Lithobius gracilis* v. Porath, Ofvers. Kongl. Vet.-Akad:ns Förhandl., arg. 26, pag. 641.

1871. *Lamyctes fulvicornis* Stuxberg, Ibidem, arg. 28, pag. 504.

1872. " " Meinert, Naturhist. Tidsskrift, 3:dje Række, 8:de Bind, pag. 343.

Hab. in civitate New York ad Mount Lebanon (G. Eisen).

Species Lithobioidarum Americæ Borealis huc usque cognitæ hoc modo distinguendæ.

	Antennæ articulis	Coxæ pedum maxillarium 2:di paris dentibus	Pori coxales (ubi numerosi in series plures irregulares digesti sunt * * * * significantur.)	Pedes 1:mi paris calcaribus	Pedes penultimi unguibus (ungue)	Pedum analium articulus 1:mus calcaribus (calcari)	Pedes anales calcaribus (articulorum 2:di, 3:tii 4:ti, 5:ti)	Pedes anales unguibus (ungue)	Longitudo corporis m. m.
1. Eulithobius multidentatus		12-19							25
2. Neolithobius vorax	40-48	12-14	6, 7, 8, 6-9, 10, 9, 7	2, 2, 1	2	1	1, 3, 3, 1-1, 3, 3, 2	1	20-22
3. " mordax	32-37	12-14	7, 8, 9, 6-8, 10, 11, 6	2, 2, 1	1	0	1, 3, 3, 1-1, 3, 3, 2	1	20-26
4. " transmarinus	38	12	5, 8, 7, 5-6, 8, 7, 5				1, 3, 3, 2		12
5. Lithobius Xanti	20	14-20	* * * *	2, 2, 1	2	2	1, 3, 2, 1-1, 3, 3, 1	1	18-25
6. " planus		14							
7. " Saussurei	27	10	5, 6, 7, 6	2, 3, 2	2	1	1, 3, 3, 1	2	23
8. " forficatus	36-48	10-14	6, 6, 6, 5-12, 10, 9, 8	2, 3, 2	2	0	1, 3, 3, 1-1, 3, 3, 2	1	15-26
9. " Aztecus	30	12							23
10. " Mystecus	36-48	6-8	3, 4, 4, 3	0, 1, 1	2	1	1, 3, 2, 0		13(18)
11. " paucidens		4							25
12. " pinetorum		4-6							15
13. Pseudolithobius megaloporus	19-20	4-6	2, 2, 1, 1, 1	1, 1, 1	2	0	0, 1, 1, 0	1	12
14. Hemilithobius eucnemis	20-(24)	6	4, 5, 5, 4	1, 2, 1	2	1	1, 3, 3, 1	2	13
15. Archilithobius bipunctatus		18	* * * *						25
16. " monticola	20	12	* * * *	2, 3, 2	2	2	1, 4, 3, 1-1, 4, 3, 2	1	18
17. " Toltecus	40	4							12
18. " pusio	20	10	2, 3, 3, 2	1, 1, 1	2	2	1, 3, 2, 0	1	8-9
19. " Kochii	20	4	2, 3, 3, 3	0, 1, 1	2	1	1, 3, 2, 0	2	11
20. " obesus	20	4	2, 3, 3, 3	1, 2, 1	2	1	1, 3, 2, 1	1	13
21. " paradoxus	20	4	1, 2, 2, 2	1, 2, 1	2	0	1, 2, 1, 0	1	11
22. " bilabiatus									
23. Lithobius mexicanus									
24. Lamyctes fulvicornis	24-29	6	2, 2, 3, 2-3, 4, 4, 4	0, 0, 0	3	0	0, 0, 0, 0	3	8-11

Pacific Coast Lepidoptera, No. 20. Notes on the Case-Bearing Moths, (Psychidæ,) with notices of Californian Species.

BY HENRY EDWARDS.

Among the whole of the insect races perhaps there are no more curious and interesting examples than are to be found in the family *Psychidæ*, the species of which, in the early stages of their growth, weave habitations for the caterpillars of fragments of stick, bark, lichens and other vegetable substances, carrying these singular structures about with them through the whole of their larval stage, and, in the case of the female, arriving at maturity, bringing forth her eggs, and eventually dying without once quitting her self-constructed prison. The *Psychidæ* are a portion of the great silk-spinning family of the *Bombycidæ*, but present many characters which are distinct in themselves, and entitle them to rank, as they are now by most entomologists allowed to do, as a separate and well-defined tribe.

Though containing comparatively few genera and species, they have a wide geographical distribution. Examples of the group are to be found in Europe, North and South America, West Indies, Mexico, Ceylon, Northern India, China, South Sea Islands, and Australia, being most abundant in the subtropical regions of the globe. Many of the species are, however, small in size, and it is possible that a very large number yet await the industry of observers.

In the construction of the caterpillar cases, they manifest wonderful ingenuity, and their houses are even more remarkable than those of the well-known caddis-flies among the *Neuroptera*. Pieces of bark, leaves, straws cut to a uniform length, twigs, mosses, lichens and grass, form, among the various species, the outer covering or decoration of the home, while the interior is lined with dense soft silk, the threads of which are also used to bind together the external fragments. Almost as soon as the larva is hatched from the egg, it begins the formation of its case, never quitting its habitation as it enlarges in size, but splitting it at the sides, weaving into the opening portions of the vegetable matter chosen and adding to the exterior larger pieces of stick, straw or leaves, as the case may be. "While the creature is small, and the house of no great weight, it is carried nearly upright, but when it attains size and consequent weight, it lies flat, and is dragged along in that attitude." The abdominal legs are furnished with a series of strong hooks, by which the larva retains so firm a hold of the interior of its tube that it is impossible to remove it without injury. When feeding, only the head and the first three or four segments are protruded, and if the caterpillar wishes to remain quiet, it fastens itself by strong silken threads to the branch on which it may chance to be; these threads, on a desire for removal, being bitten off close to the case.

It has the power of turning round inside of its case, and when full grown,

and about to change to the chrysalis state, it places its head downward, so that when the perfect insect is ready to emerge, it may do so from the posterior portion of the tube. And it may here be said that it is the male alone which escapes from its curious habitation. The female is, in most of the genera, totally unprovided with legs or wings, and is little more than a living bag of eggs, looking, as one author has said, "more like a grub than a moth, the head, thorax and abdomen being hardly distinguishable from each other." Her eggs are laid within the body of the tube, after which operation she dies, the first occupation of the young caterpillars being to consume the body of their mother, "a proceeding almost exceptional in the lepidopterous insects." Having done this, they leave their early home and go forth into the world to follow independent lives.

The males emerge from the chrysalis state in about three weeks, and are dull-looking moths of dark color, generally unattractive in appearance, having the antennæ in some cases deeply pectinated only at the base, and, in others, feathered throughout the whole length. They are remarkably swift in their flight, dashing themselves, in search of the females, wildly among the branches of the trees, and as their wings are delicate in structure, in many species nearly transparent, specimens in good order are very rare in collections.

The typical genus *Psyche* is mostly confined to the Old World, some forty species being there known to naturalists. The most striking examples of the group, however, in which the larva cases are sometimes four or five inches in length, belong to a genus named *Œceticus*, of which a species named *Œceticus Saundersii* is found abundantly in the West Indies, feeding upon fruit trees, and at times causing considerable damage. A closely allied form is common in Sinaloa, Mexico, some of the tubes of which, together with about sixteen species of *Psychidæ* from various portions of the globe, I have the opportunity of exhibiting this evening. I have, however, in my collection many of the cases, the perfect insects of which are unknown to me, and I may here mention that in confinement it is, from some cause or other, almost impossible to bring these creatures to maturity. During my residence in Australia, one species which, in its caterpillar state, was common upon the *Leptospermum lanigerum* (the tea-tree of the colonists), though persistently collected through several years and watched with incessant care, never reached the perfect stage, and to this day the imago is unknown to me. Nor was this due to the attacks of parasitic insects, as the substantial and somewhat formidable looking houses of the larva rendered them almost impervious to the onslaughts of ichneumons and other insect enemies. Death usually occurred after the caterpillar had undergone its change, the chrysalis gradually drying up after assuming its proper form, nor could any care and attention which I was able to bestow avert this misfortune.

Owing to the resemblance which exists between these remarkable insects and the fasces which were borne before the dignitaries of ancient Rome, one species has been termed the lictor-moth, while others are known as house-builders, sack-bearers, basket-carriers, and like appellations. According to the Rev. J. G. Wood, "the Singalese call them by a name which signifies billets of wood, believing that the insects were once human beings who stole

firewood while on earth, and are forced to undergo an appropriate punishment while in the insect state."

The species at present described as natives of the United States are very few, not more than five belonging to perhaps as many genera, being distinctly known to entomologists. The most common of these is a species called *Thyridopteryx ephemeriformis*, which, according to Dr. Harris, is occasionally abundant in Philadelphia and its vicinity, and there popularly known in its larval state as the drop-worm or basket-worm. It is at times very destructive to the arbor-vitæ, larch and hemlock trees. In California, though none as yet have been described, three species are known to me, two of which belong to the typical genus, *Psyche*; the third, and by far the most interesting, which has just been discovered by our President, Prof. Davidson, representing the genus *Œceticus*. It is, however, a matter of regret that at present the caterpillar cases of these three species are alone known, the perfect insects as yet evading our discovery.

Though, perhaps, not quite in order to give names to insects from their earlier stages alone, I am induced to offer brief descriptions of these curious creatures, and to suggest the names appended to them, in the hope that I may, by directing attention to the subject, induce observers in various portions of the State to devote their energies to the discovery, not only of the more mature conditions of the species, already imperfectly known to us, but to the detection of other forms of these most interesting insects.

Psyche fragmentella, n. sp. Hy. Edw.

Chrysalis case about an inch in length, tapering gradually to its posterior extremity, and composed externally of portions of leaves and bark, mostly ovate in shape, and from one to two lines in greatest diameter, in most cases laid flat on the silken web, and not overlapping each other. Chrysalis, pale, tawny, shining, smooth, of uniform thickness throughout.

Length, 0.40 inch.

On trunks of pine trees, Strawberry Valley, Siskiyou County. Hy. Edw.

Psyche coniferella, n. sp. Hy. Edw.

Chrysalis case a little over an inch in length, thickened anteriorly and composed of fragments of the leaves of pine, about three lines in length, laid in rows upon the silken web, and overlapping each other, in the manner of *P. graminella* and other European species. The fragments diminish in length on the posterior layers.

Grass Valley, Cal. On palings and trunks of pine trees. Hy. Edw.

Œceticus Davidsonii, n. sp. Hy. Edw. (See engraving.)

Chrysalis case about one and a half to one and three-fourths inches in length; stout, a little thickened in the middle, and composed of pieces of sticks or twigs from one-third to one and a quarter inches in length, laid side by side longitudinally, one or two pieces nearly always extending posteriorly some distance beyond the termination of the case. The fragments with which the case is covered are of different lengths, and are about fifteen in number, the interstices being filled with wood dust (most probably produced by the jaws of the insect itself), closely woven into the silken groundwork of

Cases of Œceticus Davidsonii, attached to the stem.

1, 2. Chrysalis removed from its case.

the case. The edges of the pieces of wood are always neatly rounded by the insect, and all outstanding branches are bitten off. Chrysalis, with the abdominal portions, light chestnut brown, with the wing cases almost black. It is nearly tubular in form, smooth, with some small hooks on the abdominal segments.

Length, 0.65 inch.

Discovered by Prof. Geo. Davidson on Mt. Diablo, on the branches of *Castaneopsis chrysophylla*, Dougl., (chinquapin chestnut). I have much pleasure in recording this interesting discovery by attaching to the species the name of our respected President.

It will be observed, both in the present species and one closely allied to it from Australia, that there are, as I have shown, in most of the cases, some pieces of twigs longer posteriorly than those of which the remainder of the case is composed. It has struck me that these may be intended as a means to assist the male insect, on arriving at the perfect state, to escape from the body of the tube, the twig affording foothold and enabling the creature to draw its somewhat unusually long abdomen from the aperture. I do not state this as a fact, but the subject is worth the observation of those who may be fortunate enough to have the opportunity. I suspect that the cases containing males only have these lengthened sticks, but if this be so we are utterly at a loss to understand the process by which the creature arrives during the caterpillar stage at a knowledge of its sex, and so frames its habitation accordingly.

Regular Meeting, December 1, 1876.

President in the Chair.

Donations to the Museum: From S. B. Christy, specimen of Molybdenum from Red Jacket Mine.

Professor Davidson read a continuation of his papers on Irrigation, describing the North Sea Canal of Holland.

Pacific Coast Lepidoptera, No. 21.—Descriptions of two new species of the Genus Thecla.

BY HENRY EDWARDS.

Thecla Putnami. n. sp. Hy. Edw.

♀. Upper side. Pale fawn color, shading into dark drab or stone color at the base and costal margin. Fringes entirely white. Secondaries with a series of four indistinct lunulate spots, black, edged beneath with white; anal

spot faintly tinged with golden yellow. Tails black, edged with white, and the apices also broadly white. Thorax and abdomen slate color. Antennæ dull slate, annulated with white.

Under side. Entirely grayish white. Primaries with black discal lunule and six submedian ovate black spots, each with a white ring. Near the posterior angle are four very faint black streaks, the under side of the primaries of this species bearing a close resemblance to that of many Lycænas, particularly that of Ly. Pheres. Bdv. Secondaries with black discal lunule and seven sub-median spots as in the primaries, except that the one nearest to the abdominal margin is lunulate. The marginal markings peculiar to the genus are very faintly produced; the anal spot is a blackish, cloud-edged above with orange; the second and third are blackish, with a few blue scales intermingled, visible only with a lens; the fourth black, surmounted by pale orange, and the remainder black lunules, becoming faint as they pass the median nerve.

Exp. of wings, 1.25 inch.

1 ♀ (Coll. Hy. Edw.) Mt. Nebo, Utah, July, 1875. Taken by my friend, Mr. J. D. Putnam, of Davenport, Iowa, to whom I have great pleasure in dedicating the species. I should have hesitated to describe this insect from a single specimen, but its very decided character leaves me no room to doubt that it is a new species. In this opinion I am confirmed by Mr. S. H. Scudder, to whom I submitted this and the following species, and who has included both in his "Synonymic List of American Rurales, 1876." A second specimen of *T. Putnami*, which in its general character most resembles *T. Dryope*, Edw., was taken in Colorado, in July of the present year, by Baron von Osten Sacken.

Thecla Adenostomatis. n. sp. Hy. Edw.

♂. Dull slate brown on the entire upper surface, with a slight golden reflection when viewed obliquely. Fringes concolorous. Antinnæ black, with white annulations; club, with its extreme tip orange above, entirely orange beneath. Eyes surrounded at their base by white hairs. Thorax and abdomen concolorous. Secondaries with anal angle slightly produced posteriorly, with a black streak at the base of the fringe, and above a very few blue scales. Tails short, black, with extreme tip white.

Under side of primaries slate drab, with very faint greenish tinge. Discal spot obsolete; a waved submedian unbroken line, white, edged anteriorly with dark slate; and six very faint submarginal patches of black. Secondaries, dark slate color at the base, from which along the abdominal margin are numerous white scales, giving a mottled appearance. Submedian band white, edged above with black, especially about the middle. Anal spot mottled with black and white; other markings a series of five or six lunules, black, edged above with whitish. All of these spots, when viewed with a lens, have a very faint trace of fulvous.

Exp. of wings, 1.15 inch.

♀. Similar to the ♂, except that the fringes are more decidedly white, the anal mark with a bluer tinge above, and the tail slightly longer than in the

other sex. The club of the antennæ is also wholly black, except the extreme tip, which is orange.

Exp. of wings, 1.25 inch.

25 4 ♂. Tehachepi Pass, Southern California. Taken by Mr. R. H. Stretch, July, 1875. Closely allied to *T. Tetra*, Behr, but differing from that species by the apparently utter absence of fulvous, which is only distinguishable by a powerful lens. It is also slightly a larger insect than *T. Tetra*, and the wings are all more angularly produced than in that species. It is, however, sufficiently near to be confounded with it, and probably may be found in other localities in California.

Remarks on the Crustacea of the West Coast of North America, with a Catalogue of the Species in the Museum of the California Academy of Sciences.

BY W. N. LOCKINGTON.

GRAPSOIDEA, OR OCYPODIDÆ.

OCYPODIDÆ.

Ocypoda Gaudichaudii? Edwds. & Luc. D'Orbigny's Voy. in Am. Merid. Crust., p. 26, pl. XI, fig. 4.

As I have not seen Edwards' description of this species, I subjoin a short description:

Carapax slightly wider across the centre than in front. Lateral angles of anterior margin very prominent, upper orbital border sinuate; front narrow, eyes large. Right cheliped much larger than the left in both sexes; arm trigonal, with its inferior surface somewhat concave, in consequence of both its margins being slightly raised and beset with spinous tubercles; the upper margin rounded, rugose with rows of small tubercles. Carpus short and stout, with a sharp spine on its anterior border at distal end, and rows of small tubercles above, becoming more prominent and somewhat spinose distally. Manus broad and thin, covered with tubercles exteriorly; a row of saw-like spines along the lower margin continued along the propodal finger, which is cristate, hooked at end, and with several teeth internally. Movable finger similar to fixed, spinose along its upper margin.

Ambulatory limbs flattened; merus with a sort of roll on its upper margin, crossed by tubercular rugæ. Carpi of second, third and fourth pairs setose at distal lower extremity; propodi of the same three pairs setose below; carpus and propodus of fifth pair without hairs; all the dactyli fringed in front with setæ. Third joint of outer maxillipeds narrower, and about half the length of the second joint.

First two segments of male abdomen very short; third and fourth longer, fifth still longer, sixth longest. Fifth segment narrowest; sixth convex on both sides; seventh a small truncate triangle. Fourth and fifth segments of

female abdomen widest; sixth a semi-ellipse, with the small seventh segment inserted in a concavity of the anterior margin.

	♂	♀
	M. M.	M. M.
Greatest length of carapax	45	32
Greatest width of carapax	53	37.5
Length of right manus	48	28
Width of right manus	28	15

Several specimens from Magdalena Bay, West Coast Lower California; La Paz, Lower California; and Boca de las Piedras, Sinaloa, Gulf of California.

O. Gaudichaudii was found at Panama by Mr. Sternbergh (Stimpson, Notes on North Amer. Crust., p. 15); and also in the Gulf of Fonseca, Central America, by J. A. McNeil (S. T. Smith, Peabody Acad. Sci., 1869, p. 91).

No. 43. Male and female. Gulf of California. W. J. Fisher.

Genus Gelasimus.

Six species of this genus are included in the collection of Mr. W. J. Fisher. One only of these belongs to the section having a narrow front, with the bases of the ocular peduncles close together. This is the *G. princeps* of S. T. Smith.

Another species, having the fourth, fifth and sixth abdominal segments united, is certainly the *G. gibbosus* of the same author. Another I believe to be the *G. brevifrons* of Stimpson.

None of the remaining kinds answer to Stimpson's and Smith's description of *G. panamensis*, so that unless two of them are referable to the Chilian species, *G. macrodactylus* and *G. stenodactylus*, it is fair to suppose they are new species. I have described two of them as new, and the remaining one, with some misgiving, I provisionally refer to *G. stenodactylus*.

Gelasimus princeps. S. T. Smith. Trans. Conn. Acad., 11, 120, plate 11, fig. 10; pl. 111, f. 3-3c.

This species is found in holes under rocks at low tide. The female, as noticed by S. T. Smith, differs considerably from the male, having the carapax less narrowed behind, with granules thickly scattered over the dorsal regions.

Two large specimens measure:

	♂	♀
	Inch.	*Inch.*
Extreme width of carapax	1.65	1.37
Extreme length of carapax	1.03	.35
Length of large hand	3.00	
Width of large hand	0.95	

Localities—Magdalena and San Bartolomé Bays, West Coast Lower California. W. J. Fisher. Corinto, Nicaragua. J. A. McNeil.

No. 51. Male and female. Magdalena Bay, in spirits. Fisher and Lockington.

G. heteropthalmus. S. T. Smith, *loc. cit.*, 116, pl. 11, f. 6; pl. 111, f. 1–16. Gulf of Fonsecá, West Coast Central America.

G. heteropleurus. S. I. Smith, *loc. cit.*, p. 118, pl. 11, f. 7; pl. 111, f. 2–26. Gulf of Fonseca, W. C. Cent. Amer.

G. armatus. S. T. Smith, *loc. cit.*, p. 123, pl. 11, f. 5; pl. 111, f. 4–4*d*. Gulf of Fonseca.

G. ornatus. S. T. Smith, *loc. cit.*, 125, pl. 11, f. 9–9*a*; pl. 111, f. 5–5*c*. W. C. Cent. Amer.

G. brevifrons. Stimpson. Ann. Lyc. Nat. Hist., New York, vol. vii., p. 229. S. T. Smith, *loc. cit.*, 131.

I have not seen Stimpson's description of this species, but from Smith's comparison of its carapax with that of *G. minax*, I conclude that several specimens collected by Mr. Fisher on the West Coast of Lower California, belong to this species. The meros of the larger cheliped is stout, triquetral, and marked on its exterior surface with transverse setose striæ; the carpus has a rounded tooth at its inferior distal end, and the manus is large and heavy, twice as large as the width of the carapax, the palmar portion rounded and smooth, but minutely granular on the outside, and on the inside beset with small tubercles on its more elevated portions. The depression for the carpus is short but very deep, the thin upper edge of manus curving inwards over it. The propodal finger is slightly deflected downwards, and the dactylus curved from the base, the curve increasing towards the tip. The tubercles of the inner edges of the fingers are very indistinct, except one near the centre of the propodal finger, and another close to the tip, which thus appears bifid.

In the smaller cheliped the tips of the fingers are obtuse and rounded, and the outer edges raised, so that they are imperfectly spoon-shaped. The dactylus and propodal finger are almost parallel and near each other, but touch only at the tip, where they have a few setæ.

The meral segments of the ambulatory legs are plicate, like those of the chelipeds.

Following are the dimensions of two large specimens:

	♂ M. M.	♀ M. M.
Length of carapax	17	13
Width of carapax	23	19
Length of larger hand	45	

The fourth, fifth, and sixth segments of the abdomen in the male are not united.

The carapax in this species is considerably narrowed posteriorly, is much less convex than usual in the genus, and of an olive color. The chelipeds of the female closely resemble the smaller cheliped of the male.

No. 85. Male and female. Magdalena Bay, in spirits. Fisher and Lockington.

Gelasimus stenodactylus? Edwds. & Lucas, Voy. dans L'Amer. Mer. Crust., 26 pl. 11, f. 2. M. Edwds. Ann. des Sci. Nat., 3d serie. Zoöl., tome xviii., p. 149. S. T. Smith, *loc. cit.*, 139.

I have not seen the description of this species by Edwds. and Lucas, and therefore question its identity with a single male specimen of a *Gelasimus* with very short fingers that was brought from the West Coast of Lower California by Mr. Fisher.

The fingers of the larger cheliped are very short, the dactylus does not attain the length of the inferior margin of the palm, and the propodal finger is much shorter.

The manus of the smaller cheliped resembles that of *G. gibbosus*. The carapax is highly convex, the anterior lateral angles almost in a line with the front, so that the orbital border is but slightly sinuous; the inferior orbital border dentate, and the lateral margins converging.

	M. M.
Length of carapax	7
Breadth of carapax	13
Length of larger hand	14

Gelasimus rectilatus, nov. sp.?

Among the *Gelasimi* collected by Mr. Fisher on the West Coast of Lower California are two specimens which I cannot refer to either of the broad-fronted species from this coast, described by S. I. Smith and Stimpson, viz: *G. gibbosus*, *G. panamensis* and *G. brevifrons*. As I have not seen the descriptions of *G. macrodactylus* and *G. stenodactylus*, it may possibly be one of these, though neither name seems applicable.

I append a short description:

Front narrower than usual in the broad-fronted section of this genus, not much more than half the width of the buccal frame; carapax tapering posteriorly, the sides forming an almost straight line from the antero-lateral angles to the straight posterior margin; antero-lateral angles much posterior to the line of the front, acute and with considerable lateral projection. Upper orbital border highly sinuous entire, lower orbital border toothed at its outer angle. Outer maxillipeds greatly gibbous, the buccal area separated from the jugal by a distinct depression. Larger cheliped smooth (microscopically granulated), except on inner surface of manus, where there is a line of small tubercles on the inner edge of the propodal finger, and a second on the ridge proceeding upwards from the lower edge of that finger. Fingers tubercular on their inner edges, the largest tubercles that in the centre of the length of each, and that near the tip of propodal finger. Fingers of smaller cheliped parallel, equal, imperfectly spoon-shaped.

Hands of female similar to the smaller cheliped of male. Ambulatory feet

entirely smooth, with a few hairs. Abdomen of male with all the joints distinct, gradually narrowing from the base.

	♂	♀
	M. M.	M. M.
Length of carapax	9	8.5
Width of carapax	14	13
Length of larger hand	19	

The larger hand greatly resembles that of the species I have referred to *G. brevifrons*, but the fingers are proportionally shorter, a character which may, however, be due to immaturity. The great differences between this form and *G. brevifrons* are the entire want of the meral plications, and the form of the lateral margins of the carapax, which in the latter continue nearly perpendicular to the front for some distance before they commence to converge.

A single pair is all I have seen of this form. The great convexity of the carapax, and the absence of any coarse granules on the front and anterior part of the branchial regions, distinguish it from *G. panamensis*.

Gelasimus crenulatus. nov. sp.

Carapax highly convex, transverse, antero-lateral angles acute and prominent, slightly posterior to the front; superior orbital margin sinuous, inferior crenulated, the teeth equal in size and with a straight upper edge.

Dorsal surface smooth and shining; median and lateral gastric regions clearly marked off; cardiac distinct; branchial regions prominent, tumid, each divided in two by an indistinct sulcus, parallel with the lateral margins of the carapax.

A broad ridge on the inner edge of the fourth joint of outer maxillipeds, continued downwards along the greater portion of the inner edge of the third joint. Merus of greater cheliped stout, triquetral, marked with numerous short, transverse, not prominent rugæ. Carpus and manus smooth and unarmed, except a few small tubercles on the raised line anterior to the depression for the carpus on the inside of the manus. Propodal finger long and slender, pointed at tip, and with a tubercle in the centre of its length. Dactylus longer than propodal finger, curved, the tip of the curve considerably overpassing that of the latter. Merus of smaller hand slender, triquetral, smooth, carpus smooth, about equal in length to the palm of the manus; fingers equal, parallel, near together, touching at tips, which are pointed.

Hands of female like those of smaller male cheliped. Ambulatory feet smooth and shining, with a few long setæ on the propodi, and more numerous and shorter setæ on the dactyli.

The hand of this species is similar to that of *G. brevifrons*; the gibbous carapax, with its areolations, resembles closely *G. gibbosus*, but the third, fourth and fifth segments of the abdomen are free, instead of anchylosed, as in that species; and the margins of the carapax again resemble those of the species I have referred to *G. brevifrons*, but the convexity of the surface, with the tumid branchial regions, give it a very different appearance.

Unless this is the *G. macrodactylus* of M. Edwards, found on the coast of Chili, it is certainly a new species.

No. 49. Todos Santos Bay, near San Diego, dried. Hy. Hemphill.
No. 50. " " " " " in spirits. Hy. Hemphill.

Gelasimus gibbosus. S. I. Smith. Trans. Conn. Acad., March, 1870, 140; plate 11, f. 11; pl. iv., f. 8.

Numerous specimens from the West Coast of Lower California, principally from San Bartolomé Bay, agree with Smith's description and figure of this species in every particular, except in having the front more suddenly curved forwards. The sub-hepatic regions are thickly setose.

The fingers of the smaller cheliped are equal in length, and twice as long as the broad, stout, and short palmar portion of the manus; they are widely separated at their base, gape throughout their length, and are curved to meet each other at their extremities, which are of a yellowish brown tint. There are a few scattered hairs on the fingers. In the female both chelipeds are exactly like the smaller cheliped of the male.

The depression between the buccal and sub-hepatic (jugal) areas is very distinct; the teeth of the inferior margin of the orbit increase in size and slenderness on the outer portion; and the fourth, fifth and sixth abdominal segments are anchylosed. The prevailing tint of the carapax and limbs (in spirits) is blue, of varying intensity, shading in parts into greenish and into white on the fingers of the chelipeds. Many very small specimens have the fingers of the larger cheliped but little developed, not exceeding the palm in length, and closely approximated to each other.

At first I thought these to be a distinct variety, but now believe them to be the young of the same species, as they agree in every other particular, and some show evidences of a change in the relative proportions of the palm and dactyli as growth progresses.

No. 86. Male and female, in spirits. Bartolomé Bay. Fisher and Lockington.

GECARCINIDÆ.

Cardiosoma crassum.? S. I. Smith, *loc. cit.*, 144; pl. v., f. 5. Gulf of Fonseca, W. C. Cent. Amer. La Paz, Lower California.

A single fine male specimen from the latter locality agrees in most particulars with the figure and description referred to, but the carina of the lateral margin is much less distinct and high; and the larger hand differs in form.

As the specimen exceeds in size any of those measured by Mr. Smith, I think it possible that the differences referred to may be owing to the greater age of the individual; but as it may possibly prove to be a different species, I append a description of the chelipeds.

Merus and carpus as in *C. crassum*; larger hand short and broad, the depth exceeding the length of the superior margin. Propodal finger slender and straight, slightly spoon-shaped at extremity, with a large tooth near the

centre of its length, and several smaller teeth. Distal end of manus forming an angle of about 80° with the superior margin, and of about 60° with the propodal finger, which does not increase greatly in width towards its base. Dactylus slender with a large tooth nearer the base than the tip, which is inflated and spoon-shaped. Inner surface of the hand, towards the margins, armed with scattered tubercles of small size. Upper portion of manus curving inwards posteriorly, the carpus fitting, when the hand is bent, into the hollow between the upper incurved carina and lower thick portion of the manus. The smaller hand is similar to the larger. The stoutness of body of this crustacean is such that the sides of the branchial and hepatic regions are visible from above, and protrude laterally beyond the antero-lateral carina. The male appendages agree with those of *C. crassum*.

	M. M.
Greatest length of carapax, measured along its convexity....	100
Greatest width of carapax..............................	101
Length of larger hand to end of propodal finger..................	127
Length of larger hand from carpus to base of dactylus............	40
Greatest width of larger hand.....................................	58
Width of carapax between antero-lateral carinæ in front...........	93

If this should prove, on examination of more specimens, to be a new species, I propose to name it *Cardiosoma latimanus*.

Gecarcinus quadratus. De Saussure. Revue et Mag. de Zoöl., v., 360; pl. xii., f. 2.

The work above referred to is not accessible to me In Mr. S. I. Smith's Notes on American Crustacea, Trans. Conn. Acad., vol. ii., *Cardiosoma quadratum*, Saussure, is referred to. Are they identical ?

The male appendages of *C. quadratum* figured in the plate iv. of the notes cited above differ from those of the *Cardiosoma* described under *C. crassum*.

Mazatlan.

BOSCIADÆ.

Potamocarcinus armatus. M. Edwards. Archiv. du Mus., vii., 174; pl. xiii. Obtained in the North Pacific Exploring Expedition in Lake Nicaragua. Stimpson. Prod. des Animal, evert, p. 46.

GRAPSIDÆ.

15. *Grapsus strigosus*. Latreille. Stimpson, Crust. & Echi., P. S. N. A., says: "Specimens in the Brit. Mus. from Lower California are referred to this species by White." White, Brit. Mus. Cat. Crust., p. 40.

Numerous specimens of a *Grapsus* from Lower California agree in every respect with the remarks upon this species in Dana's Crust. U. S. Ex. Exp., vol. 1, p. 338 ; having the merus of the right posterior legs three-toothed at its distal end, instead of entire, as in *G. pictus*.

No. 52. Mazatlan, dried. Henry Edwards.

No. 53. Locality unknown, dried. Donor unknown.

16. *Grapsus pictus*. De Saussure; Revue et Mag. de Zool., V., 362; Stimpson, Crust. & Echi., P. S. N. A., 26.

Stimpson doubts the identity of De Saussure's *G. pictus* with that of Latreille. I have as yet, among abundant specimens of crustacea from the east and west coast of Lower California, received but one species of *Grapsus*, and this does not agree, either in coloration or in the merus of the posterior legs, with the *G. pictus* described by Dana, Crust. U. S. Ex. Exp., 1, 337.

16. *Pseudograpsus,* / *Heterograpsus,* } *Oregonensis*. Dana, U. S. Ex. Exp., Crust., 1, 334, pl. XX, f. 6; Milne Edwards, Melanges Carcinologiques, 157; Stimpson, Proc. Cal. Sci., 1, 38.

No. 54. Three males, dried, S. F. Bay. Lockington.
No. 55. Several specimens, S. F. Bay. *Ibid.*

17. *Pseudograpsus,* / *Heterograpsus,* } *Nudus*. Dana, U. S. Ex. Exp., Crust., 1, 335, pl. XX, fig. 7; Milne Edwards, *loc. cit.*, p. 159; Stimpson. *loc. cit.*, 1, 38.

No. 56. Several specimens, S. F. Bay. Lockington.
No. 57. Several specimens, Black Point, S. F. Bay. Lockington.

18. *Goniograpsus pulcher*. nov. sp.

Carapax with numerous transverse lines, not extending to the central regions. Sulcus between gastric and cardiac regions, very distinct. One antero-lateral tooth behind the post-orbital. Sides convergent posteriorly. Perpendicular portion of front about four times as long as high. Outer antennæ exsert. Outer maxillipeds widely separated, narrow. Chelipeds subequal, merus triquetal, with the upper margin rounded, lower anterior ditto, produced into a wing-like keel, armed with about nine teeth on its edge; posterior margin toothed. Two or three teeth on the anterior edge of the ischium. Carpus with three teeth on its upper anterior angle. Manus broad and thin, smooth exteriorly, tubercular interiorly. Dactylus tubercular above. Upper surfaces of the merus crossed by transverse raised lines similar to those of the carapax. Carpus crossed, also, by rugæ, which show a tendency to split up into tubercles. Tubercles of manus arranged in longitudinal rows along its upper margin. Ambulatory legs, with the distal end of merus three-toothed, the upper tooth sharp, the two others long and rounded lobes; terminal joints with scattered hairs; dactyli spinose. Abdomen of the male with the two first joints very short, the third joint widest, and with strongly convex sides; remaining joints regularly diminishing in width, with a slight convexity. Color citrine, with a variable reticulation of dark brown, the ground becoming yellowish upon the legs. Chelipeds bright red.

Several specimens of both sexes from Magdalena Bay, west coast, Lower California.

The measurements of two average-sized specimens are as follows:

	♂	♀
Greatest length of carapax	40	30
Greatest width of ditto	43	34

The branchial regions are much elevated in old specimens.

I have preferred to employ Dana's name of *Goniograpsus* in preference to Randall's *Pachygrapsus*, as the generic characters given by the former author are the more precise and definite.

This species appears to be very near to the *Goniopsis cruentatus* of De Haan, but that species has the hand, carpus, and dactylus small spinulous above.

No. 58. Magdalena Bay, in spirits. W. J. Fisher.

19. *Pachygrapsus* (*Goiograpsus*) *crassipes*. Randall, Jour. Acad. Nat. Sci., Phil., VIII, 137; Stimpson, Crust. & Echi., P. S. N. A., 27.

No. 59. Several specimens, S. F. Bay. W. N. Lockington.

20. *Goniograpsus* (*Pachygrapsus*) *transversus*. Gibbes, Amer. Asso. Adv. Sci., 1850, p. 181; Stimpson, Ann. Lyc. Nat. Hist., N. Y., vol. VII, p. 64; S. I. Smith, Rep. Peabody Acad. Sci., 1869, p. 91.

The last named writer mentions specimens from Havana, the Gulf of Fonseca, and other points of the Pacific coast.

I have not seen either the species or a description of it, and therefore cannot be certain that the species just described may not be identical with it; but if so, the name *transversus* is very inapplicable.

21. *Glyptograpsus impressus*. S. I. Smith, Trans. Conn. Acad., vol. II, p. 154. Acajutla, west coast, Central America.

32. *Goniopsis cruentatus*. De Haven; S. I. Smith, Rep. Peabody Acad. Sci., 1869, 91.

23. *Sesarma sulcata*. S. I. Smith, Trans. Conn. Acad., *loc. cit.* p. 156.
Corinto, W. coast Nicaragua.

24. *Sesarma occidentalis*. S. I. Smith, *loc. cit.* p. 158.
Acajutla, W. coast Central America.

25. *Sesarma augusta*. S. I. Smith, *loc. cit.* p. 159.
Pearl Islands, Bay of Panama.

26. *Aratus Pisoni?* M. Edwds, Ann. Sci. Nat. 3d ser., 1853, tome XX, p. 187. Hist. Nat. des Crust. II, p. 76, pl. 19, f. 45.

"A specimen from Corinto, Nicaragua, appears to belong to this species, but it has not been carefully compared with east coast specimens." S. I. Smith, Rep. Peabody Acad. Sci., 1869, p. 92.

GONOPLACIDÆ.

27. *Prionoplax ciliatus*. S. I. Smith.
Panama.

Prionoplax spinicarpus. M. Edwds., Ann. des Sci. Nat., 3d series, XVIII, 161. *Ibid.* Archives du Mus. d'Hist. Nat., VII, 167, Pl. VI, f. 3. Stimpson, Notes on N. Amer. Crust., 13.

28. *Euryplax politus.* S. I. Smith.
Panama.

29. *Glyptoplax pugnax.* S. I. Smith.
Panama.

30. *Eucrate Californiensis.* Lockington, Proc. Cal. Acad. Sci., Feb. 7, 1876.
No. 61. San Diego, (Hy. Hemphill), dried.

This species is certainly neither of the preceding, but appears to closely resemble Stimpson's *Speocarcinus Carolinensis.*

PINNOTHERIDÆ.

31. *Pinnotheres faba.* Dana, U. S. Ex. Exp., 1, 381, pl. 24, fig. 4. *Pinnixa faba.* Stimpson, Crust. and Echi., P. S. N. A., p. 30.
Found in the large Lutraria of the Oregon coast.

32. *Pinnotheres margarita.* S. I. Smith, Trans. Com. Acad., Vol. II, p. 166, Verrill, Amer. Nat., III, 245.

Two females of this species was brought by Mr. W. J. Fisher from Mulege Bay, Gulf of California.

"Everywhere covered, except the dactylus of the right ambulatory leg of of the second pair in the female, and tips of the others in both sexes with a very short and close, clay-colored pubescence, much like a uniform coating of mud."

Found in the pearl oyster, *Margaritophora fimbriata.*

A new species of *Pontonia* (*P. margarita*, Lockington,) is mentioned by Mr. Fisher as having been taken from *Margaritana margaritifera*, at Port Escondido, Gulf of California, but as Mr. Fisher's collections were almost exclusively marine, it is not unlikely that the above mentioned mollusk was the one he meant to indicate.

33. *Pinnotheres lithodomi.* S. I. Smith, Trans. Conn. Acad., *loc. cit.*
From *Lithodomus aristatus*, Pearl Islands, Panama.

34. *Pinnotheres angelica.* nov. sp.

Carapax smooth and shining, soft and slippery, without sutures, (when undried) somewhat transverse. External maxillipeds widely divaricate posteriorly; the third joint shaped like a boomerang, the external convex margin more curved than the concave internal margin; distal extremity rounded and ciliate on its internal edge, terminal joints ciliate. Chelipeds smooth, cylindrical, save that the manus is somewhat compressed distally; dactylus short, about half as long as the posterior part of the propodus, and equal in length to the propodal finger; both fingers hooked at the end, without teeth on their

internal borders. Ambulatory legs slender, cylindrical, smooth, dactylus of first pair short, that of second pair about as long as the propodus; those of third and fourth pairs equal in size, rather larger than that of first pair and about half as long as the propodi; that of fourth pair ciliate on its internal margin. Abdomen very large, wider than the carapax and covering the maxillipeds and even the eyes, when folded.

Several specimens, all females, were collected at Angeles Bay, Gulf of California, September, 1876, "in oysters."

	♂ M. M.	♀ M. M.
Length of carapax	11.5	9
Width of carapax	15	12
Breadth of abdomen	16.5	13.5

Many of the specimens are loaded with ova.

35. *Fabia subquadrata.* Dana, U. S. Ex. Exp., I, 882, pl. 24, fig 5. Stimpson, Crust. & Echi. P. S. N. A., 30.

Puget Sound. Farallone Islands.

No. 83. In spirits, from mantle of *Pachydesma crassitelloides.* San Diego, (Hy. Hemphill.)

36. *Dissodactylus nitidus.* S. I. Smith, Trans. Conn. Acad. Sci., 1869, 173.

Panama. Gulf of California. (Fisher.)

Two females from the latter locality have the peculiar bifurcate dactyli, from which Mr. S. I. Smith has named the genus *Dissodactylus*, and probably belong to *D. nitidus*, of which that author describes the male. The carapax is firm, somewhat wider at the lateral angles than posteriorly; convex in front and at the margins, without any upturned border along the antero-lateral margin, but with a short fissure extending obliquely inwards immediately anterior to the lateral angle. The posterior margin has an upturned border. There is no pubescent tuft on the inferior edge of the propodal finger. The ambulatory legs are as in the male. The abdomen resembles that of *Pinnotheres*, the terminal article reaching and partly covering the buccal frame. The prevailing color is dark purplish brown, with spots of white upon the carapax, and a ring of white at each joint of the limbs. The dactyli are white.

37. *Pinnixa ? nitida.* nov. sp.

Male. Carapax exceedingly transverse, smooth, shining, color in spirits, bright orange; all the limbs smooth and shining, without pubescence, of a straw yellow color. Maxillipeds very small and triangular, closely fitted to the buccal area, smooth and shining, as is also the sternum. Abdomen narrow at base, second segment rapidly widening, third widest, fourth, fifth and sixth tapering rapidly, seventh almost as long as wide, triangular, with the apex rounded. The abdomen does not cover more than one-half the sternal area. Chelipeds shorter than either second or third pair, the manus broad, with two setose ridges on its anterior surface, fingers short, hooked, toothless, movable finger oblique. Three last joints of ambulatory limbs flattened, carpus broad at distal extremity, scarcely longer than wide; propodus nearly twice as long as wide; dactylus slender, cylindrical, white, ending in a sharp yellow claw. Margins of last three joints setose, second pair (first ambulatory pair)

longer than the third, which are themselves longer than the chelipeds, fourth pair shorter, fifth very short.

	M. M.
Width of carapax	11
Length of carapax	5

Female. Carapax broadly transverse, smooth, shining, margins curved, angles rounded. Outer maxillipeds much larger than in the male just described, parallel, tomentose. Chelipeds shorter than fourth pair, hand short and rounded, wider than thick, tomentose, propodal finger short, hooked, dactylus oblique, hooked, toothless. Merus, carpus and propodus of all the ambulatory limbs greatly compressed; propodus as long as wide; carpus nearly twice as long as wide; dactylus short, cylindrical, ending in a sharp claw. Abdomen broad, covering the whole sternum, and fringed with long hairs round its margin. The pubescence of the chelipeds is continued along the fingers nearly to their tips, and is found also on the external portions of the carpus and flattened joints of the ambulatory limbs, as well as on the hepatic region. The color, where free from pubescence, is a brownish yellow (in spirits).

	M. M.
Length of carapax	7.5
Width of carapax	14

A single specimen of each the two crustaceans just described was collected on the same day at the same locality, namely, Angeles Bay, Gulf of California, and the two were placed by the collector (Mr. W. J. Fisher) in the same phial. Had it not been for this, I should certainly have never linked together two specimens so distinct in the relative proportions of the limbs themselves, as well as of the joints of those limbs; one covered in many places with an abundant pubescence, the other smooth and shining above and below. The proportions of the ambulatory limbs in the female agree with the genus *Pinnixa*, but in the male the increase of size is transferred to the second pair. Should these crustacea prove to be distinct the female should be *Pinnixa tomentosa*, while the male must be placed in some other genus.

I have no means of ascertaining upon what species of invertebrate animal these crustacea resided as commensals.

38. *Pinnixa longipes*. (*Tubicola longipes*. Lockington, Proc. Cal. Acad. Sci., April 17, 1876.)

This species should properly be placed in the genus *Pinnixa*. It possesses the characters of transverse carapax, and elongated fourth pair, in an extraordinary degree.

No. 60. Tomales Bay. (Lockington.) in spirits.

When I wrote the description of this species, I was not aware that any species of Pinnothere had previously been found quartered upon a worm, but I have since found that Stimpson (Notes on N. Amer. Crust., 21, 23) mentions two species, both belonging to this genus, that live in similar localities.

These species are, *P. cylindrica*, which inhabits the tube of the *Chætopterus*, of South Carolina, and *P. lævigata*, which lives with the lobworm, *Arenicula cristata*, in its hole, not lined by any tube, in the sand.

A New and Expeditious Method of Placing the Transit.

BY T. J. LOWRY.

The most approved methods of finding latitude and time are those with the telescope in the plane of the meridian; and hence this plane is the first object of the practical astronomer's search in the observatory. The methods now understood by the astronomer of getting his instruments in the meridian are all trial methods, each of them finding a meridian only by a series of continued approximations, consuming time and effort proportionate to the skill of the observer, the accuracy of the knowledge of his time and latitude, and the rapidity of the successive appearance of favorable stars on his meridian.

The method now proposed requires but little practice and less skill to place an instrument in the meridian by one observation only, without any knowledge of the latitude or time except to the nearest five or ten minutes.

The essential idea of this method is to observe two stars of the same, or differing twelve hours in, right ascension, but of different north polar distances, at the instant of their simultaneous passage of our meridian. Now, since our zenith is a point in the plane of our meridian, and since the plane of the declination circle of any two stars of exactly the same, or twelve hours different, right ascensions, is by the diurnal revolution of the earth made to coincide successively from east to west with every terrestrial meridian, it is obvious that we have but to (select and) observe two such stars at the instant that they and our zenith are in the same vertical plane and clamp, and we have our instrument fixed in the plane of its meridian.

To accomplish this simultaneous observation of two such stars with a transit, zenith telescope or theodolite, we attach to the tube of the telescope directly in front of its object-glass a plane mirror, half silvered to admit of direct and reflected vision, with its axis of rotation horizontal, parallel to its plane of reflection and perpendicular to the line of collimation of the telescope. Attached to this axis is a small vertical finding circle for setting this mirror at any desired angle with the collimation line. In form this mirror may be either an elliptical ring with only the quicksilver removed (or the glass also cut away) from its center, or that of the ordinary sextant horizon glass with its silvered half uppermost. This mirror should have its front and back faces perfectly parallel, and be from one-fourth to one-third of an inch thick, so that by having on its front face two fine lines cut at right angles to each other, we can, by making the reflected image of each of these lines coincide with its direct image, adjust its plane of reflection perpendicular to the telescope's collimation line, and thus also find the index error of its finding circle. In this adjustment use the collimating eye-piece.

This method of getting one star of a pair into the telescope field by a single reflection, and the other by direct vision, will work admirably when the stars differ considerably in north polar distances; but when this difference is small and we point on one of the stars direct, it becomes imperative to subject the

other to a double reflection, by using an additional mirror, as in the sextant, or employing the principle embodied in the Steinheil heliotrope. We may, however, avoid this double reflection of either of the stars of such a pair by pointing the telescope on the artificial horizon image of one of them, and thus get the other into the telescopic field by a single reflection.

When the stars of a pair have the same right ascension, we will have them enter the field of the telescope on the same side and move across in the same direction, the faster mover, as it were, chasing the slower, and catching up with it at the instant of their simultaneous passage of the meridian. But with a pair of stars differing twelve hours in right ascension, *i. e.*, one of them culminating *sub polo*, they will enter the telescope field on opposite sides, move across and meet exactly on the meridian. It is hence obvious that a pair whose stars differ 12 hours in right ascension offers the advantageous feature of the sum of their motions to aid the observer in deciding upon the exact instant of their coincidence in the telescope field, whereas with a pair having the same right ascension he has only the difference of its stars' motions to assist him in gxing upon this instant.

But when the catalogues do not offer star pairs culminating at desirable times, of suitable magnitudes and declinations, and of the same or exactly 12 hours different right ascensions, and thus permitting the application of the method in its greatest perfection, we may yet find our meridian most accurately by selecting and observing suitable pairs, the right ascension of whose stars differ but a few minutes from being identical, or exactly 12 hours different. Now the zenith of a position is a point common to all its vertical planes, and since the plane passing through the earth's center and any two stars differing more in declination than in right ascension, is, by the diurnal revolution of the earth, made to coincide successively with one of the vertical planes of every point on the earth's surface, we hence have but to observe two such stars at the instant they and our zenith are in the same vertical plane, and clamp, and we have our instrument in a vertical plane whose deviation in azimuth is determined by, and easily derived from, the north polar distances of the two stars, the difference of their right ascensions, and the co-altitude of one of the stars (or our co-latitude), we can observe the co-altitude of one of the stars at the instant of their coincidence in the telescope field. Having selected a list of such star pairs, we can readily compute a table from which an observer at any known latitude can pick out the azimuthal deviation of his instrument in degrees, minutes and seconds, at the instant two such stars coincide in his telescope field. Or, instead of using the co-latitude, which must then be known, we can use, in the preparation of such a table, the zenith distance of one of the stars; otherwise we may tabulate the hour angle in time (minutes and seconds) of the hinder of the two stars at the instant of their coincidence in the field of the telescope, either for the different altitudes of this star or for the different latitudes.

The method of observing such a pair with the aid of the last named table will be as follows: Having taken care in selecting to have one of the pair a star of such magnitude and position as to be readily identified by a stellar chart or allineation, we set the mirror in front of the object glass, at an angle

with the collimation line equal to one-half of the supplement of the algebraic difference of the north polar distances of the two stars, and bring the more readily identified one of them into the field of view, and follow it till its mate appears there, either meeting, chasing or fleeing from it. We then "pick the beat" of the watch or chronometer, and beginning to count the beats at the instant the stars coincide in the telescope field, follow the hinder star till the moment its "tabular hour angle" expires, and clamp, and our instrument is in the meridian.

A pair of fast-moving stars will give an accurate meridian, yet practically it will in general be found preferable to have one of the pair a star of slow motion, so that it can be readily bisected and followed until the instant its fast-moving mate strikes the middle wire, thus enabling the observer to clamp his instrument at exactly the right time without hesitation or doubt.

If the table gives the hour angle in time of the hinder star at the instant the two stars and our zenith are in the same vertical plane, then their relative right ascensions and positions with reference to the zenith must be as follows, viz: 1. If both stars are on the same side of the zenith then the star having the greater zenith distance must have the smaller right ascension, and this rule holds when one is a zenith star. 2. But if one star is south and the other north of the zenith then either may be in advance, but practically it is preferable that the slow mover "bring up the rear." 3. When a star south of or in the zenith is paired with a sub-polar, then the latter should not be quite twelve hours in advance of the former. 4. If a star north of the zenith has a sub-polar mate, then the upper culminating star should transit the meridian first, if it is the lower culminating star that we are following with the cross thread, and *vice versa*.

But if our table gives the azimuthal deviation, in degrees, minutes and seconds, of our instrument at the instant two such stars coincide in the field of its telescope (its plane of motion being, of course, vertical) then it is a matter of indifference which star precedes, since this angular deviation can be turned off either backward or forward on the horizontal limb of the instrument.

Within the latitudes of the United States the following varieties of pairs will offer, viz:

Class A. Pairs whose stars have the same, or differ but a few minutes, in right ascension. 1. Two circumpolar stars. 2. A circumpolar star and a time star, the latter being either in the zenith or south or north thereof. 3. Two time stars, either one north and one south of the zenith, or both north or both south thereof, or one star in and the other star either north or south of it.

Class B. Pairs, the stars of which differ exactly 12 hours in right ascension, or lack but a few minutes thereof. 1. Two circumpolar stars. 2. A circumpolar star and a time star either in or south or north of the zenith.

With respect to the relative motions of the stars of a pair most important to the observer in deciding upon the exact instant of their coincidence, class B is in general more favorable than class A. And the pair in class B which

furnishes the maximum amounts of azimuthal motions (in opposite directions), and hence most desirable, is a lower culminating circumpolar star and an equatorial star; while with a pair of circumpolars the sum of these motions is a minimum. And of those in class A, a close circumpolar star and an equatorial star gives the greatest difference of motions; while a pair of circumpolars gives the least. When the stars of a pair move in the same direction, and at not very greatly different speeds, they will doubtless be found to cling together in the telescope field a provokingly long time.

As to the frequency of their availability, the pairs of circumpolar stars stand pre-eminent; since they are on our meridian and its visible extension twice in every 24 hours, they are hence doubly more available than the other pairs which transit our meridian but once in that time.

As to the amount of computation required—an element only in those pairs whose stars are not exactly on the same declination circle or its visible extension—when a zenith star is paired with either a south or a north star (at upper or lower culmination), following within a few minutes, the computation is a minimum, for then the difference of the times of the stars transiting our meridian equals the difference of their right ascensions; and the zenith star obviously transits the meridian at the exact moment it and its mate are in the same vertical plane. And when its mate is a close circumpolar star their mean right ascensions will prove all-sufficient because from the slowness of its motion in azimuth the error of assuming the difference of their mean, equal to the difference of their apparent, right ascensions will in general be inappreciable. And it may often occur that the error of assuming this of two stars having nearly the same precession in right ascension will enter the resulting azimuth in so diminutive a form as to be quite allowable, except in a very close work.

If the stars chosen fall in a part of the celestial sphere illuminated by the sun as they transit our meridian, they will require to be of larger magnitudes than such star pairs as, being in the opposite part of the heavens, cross our meridian at night. Especial effort should be made to incorporate the double stars into pairs, from the facility and certainty with which they can be identified in the telescope field.

And again, if tables are available giving the exact right ascensions and declinations of Mars and Jupiter, they may be advantageously paired with suitable stars; and their continuous motion among the stars renders them more available, since they cross successively the declination circle of every star in the heavens. But the use of these planets will necessitate a more accurate knowledge of our time.

Experience has proven that, in reconnaissances, rapidity of execution in finding latitude, time and azimuth, is all-important and in many cases essential to success; and hence methods and instruments which yield a maximum amount of results in a minimum time are in especial demand. Under the contingency, often arising in reconnaissance and exploration, that the latitude is not known and the time only to the nearest five or ten minutes; and when limited in time and facilities, as the reconnoiterer or explorer *per necessitatum* generally is, then this method will be found most acceptable; for it is obvious that by bisecting one of the stars of a pair (of identical right ascension) with

the horizontal thread at the instant the two stars are on the middle vertical thread, and also at this moment noting the face time of the chronometer, that we have the meridian altitude of a star whose declination is known, and hence our latitude, and also the observed time of meridian transit of a star of known right ascension, and hence a chronometer correction, simultaneously with the observation that fixed our instrument in its meridian, the error of our chronometer, and our latitude, we can if desirable proceed at once to the observation of additional stars for a closer time and to test our latitude and azimuth.

A reflecting circle or sextant mounted on an alt-azimuth stand is *per se* (*i. e.* without an additional mirror) the instrument most convenient and ready for finding by this method the meridian, latitude and time for the reconnoiterer, explorer or land surveyor; and it may be found especially serviceable in hydrographic and geographical reconnaissances, whether in the course of an exhaustive survey, or only a flying reconnaissance of a coast or continent.

And from the readiness with which this method places "the transit" and "zenith telescope" in the meridian it will be found useful and may prove acceptable to even the most conservative practical astronomer.

Mr. Lowry finds that the B. A. catalogue offers an abundance of star pairs of suitable magnitudes, declinations and right ascensions. With the mean places of stars brought up to Jan. 0. 1877, between the siderial times 0h. 07m. and 0h. 57m. he finds 6 pair stars differing less than 3 seconds in right ascension, 4 pairs less than 7 seconds, 7 less than 16 seconds, and 5 less than 29 seconds.

A yet neater method of getting a meridonal plane is to select three stars so that stars A and B are of same declination and differ 10 or 15 minutes in right ascension, and star C differing several degrees from them in declination, but with a right ascension equal to one-half of the sum of those of stars A and B. Now observe the coincidence of stars A and C in telescope field and read horizontal circle, and then the coincidence of stars B and C in the field of view and read the horizontal circle, then set the vernier at the point midway between these horizontal circle readings and our telescope is in its meridian.

The President announced that the Council and Trustees had appointed the following Nominating Committee: Horace Davis, J. H. Smythe, S. B. Christy, Wm. Norris and P. B. Cornwall.

Dr. Wozencraft was introduced by Dr. A. B. Stout, and made some remarks on the feasibility of reclaiming the Colorado Desert of California.

Regular Meeting, December 18th, 1876.

President in the Chair.

Thirty-seven members present.

Donations to Museum: Large collection of plants from Joseph A. Clark, Mendocino County. From Dr. J. M. Hill, three specimens gold quartz, Calaveras County. From Henry Edwards, one specimen of jade from near Dunedin, New Zealand. From G. A. Treadwell, specimen of chromic iron, Forest Hill, Placer County, Cal. From A. J. Severance, specimen of porphyry, (core of diamond drill,) from 400 feet below the surface, Virginia, Nevada.

Tribulus from the Eastern Shore of the Gulf of California.

BY DR. A. KELLOGG.

Mr. Wm. J. Fisher collected the following very ornamental *Tribulus* from the eastern shore of the Gulf of California.

Tribulus Fisheri. K.

Stem annual, erect, branching from the base, the spreading stems again more or less branching at the top, somewhat nodose, striate, more or less hispid throughout, chiefly at the nodes, and 1½ feet high; leaves alternate, only the uppermost cauline and ramose, opposite, lower pinnæ largest, leaflets 6–8 or 9 pairs, oblong, subacute, submucronate, 4-6 or 7-lines long, oblique—one or more strong lateral nerves—hispid beneath, margins entire or subserrulate; stipules linear-subulate; peduncles thickened upwards, longer than the leaves, 1–3 inches long, axillary, or opposite the leaf; sepals 5–6, colored, narrowly lanceolate, acuminate, margins scarious, very bristly-hirsute on the back, less than half the length of the petals, or about 5-lines; flowers orange yellow, 2¼ inches diameter, petals five, obovate, obtuse, subcuneate, 13-lines long, 10–11 broad; style long, 3–4 times the length of the carpels and longer than the stamens, clavate, strongly 10-striate; carpels ten, 1-seeded, in a whirl around the base of the style, indehiscent, but readily deciduous at maturity from the elongated toroid style, obliquely triangular, laterally wedge-compressed, outer edge thickened, gibbous below base, and truncate, beak obsolete, pitted in two rows on the sides, crested on the back with five blunt, stout, murecoid tubercles, carpels scarcely more than a line high. Highly ornamental plant.

It is worthy of note that among Mr. Fisher's collection from Rattlesnake Island, harbor of San Diego, April, 1876, are also specimens of a variety of

Pectis papposa, Gray, which very much abounds in large dotted glands throughout, especially on the leaves (1–2 inches long, ⅛-line wide), mucronate, often slightly connate at base—opposite lower branches and similar portion of the stem purplish—slender peduncles enlarged near the base of the heads, sulcate corresponding to the 6–9 involucral scales which are dotted with 1–2 large glands on the back at the tips, margins involuted, but not scarious, infolding the ray akenes in their channels. These rigid, yellowish-green scales are rounded abruptly at the base and laterally attached; orange rays same in number, but longer, their akenes without pappus, or only a very minute united scaly crown; pappus of the disk of 20–25, tawny, rather long, unequal barbellate bristles similarly cohering.

An exceedingly beautiful and delicate pink-purplish morning-glory, brought by Mr. Wm. J. Fisher from Ajiabampo, of the Gulf of California, has very handsomely radiated leaves, adding a new glory to these very beautiful twiners. We, therefore, propose to name it

Ipomœa radiatifolia. K.

Stem slender, twining or creeping, 2–4 or more feet high, glabrous, somewhat petangular, fistulous; leaves alternate, or more rarely opposite, pedately 5–12-parted, lobes linear, filiform, mucronate, margins thickened and entire, lateral lobes subdivided into 2–4 outer lesser lobes (giving the leaves a delicate, airy, rounded, radiating outline), petioles slender, 1¼ inches long (or shorter than the longest middle, and distinct lobe), muricated (no stipules); peduncles 1-flowered, axillary, 2–3 inches long, articulated ½-inch or more below the calyx, bibracteolate at the insertion of the pedicel, bracteoles minute, subulate, scabrulose at the joint; calyx 5-sepaled, equal, naked, narrowly lanceolate-linear, acuminate, thin, 3-nerved, margins scarious, subentire; corolla purplish-pink, broadly funnel-form, 1–2 inches diameter, tube gradually enlarging to the throat of the widely expanded campanulate border; stamens and style included, unequal, filaments hirsute to the oblong saggitate anthers (scales none), style long, glabrous, stigma 2-lobed, semicircularly fan-shaped, often subdivided into minute lamellary lobules, minutely villous; Root and mature fruit unknown; embryo 2-celled, smooth.

Pacific Coast Lepidoptera, No. 22.—Notes on some Diurnal Lepidoptera, with descriptions of new varieties.

BY HENRY EDWARDS.

Mr. W. H. Edwards, of Coalburgh, West Virginia, has in view the speedy publication of a complete check list of North American butterflies, and it has been suggested by him that all facts connected with the group known to observers in different parts of the region comprised by the work, should at once be published, so as to bring together such information as may, if deemed worthy, be incorporated in the more important publication. With this view I have made the following notes on some doubtful or little-known species, at the same time calling attention to such strongly marked varieties of some of

our butterflies as seem to me worthy of special note. In these days of doubt as to the "origin of species," every trifling fact which can shed light on so important a field of inquiry becomes of striking value, and it appears to me necessary for all varieties which are apparently permanent to bear a distinguishing name, so that they may at once be recognized and hold their proper place in our nomenclature. The following remarks will be, therefore, taken at their true value, as I by no means claim that all of the forms described in this paper should rank as distinct species, though future observations may possibly elevate some of them to that position.

Parnassius Clodius. Menetries.

This species, like all of its genus, is liable to great variations, and there is little doubt that some of its extreme forms have been described under other names. Indeed, I am conscious of having unwittingly led Mr. W. H. Edwards into the error of believing that our forms represented *Clodius*, Menetr., and *Clarius*, Evers., and on my authority he has figured them as such in his "Butterflies of North America." Subsequent observations, however, led me to the conclusion that we had but one species, and the capture of some sixty or seventy specimens in Bear Valley in 1873, gave me a long series of intergrades, in which both of the forms above alluded to were certainly included, and with the knowledge that *Smintheus* and *Behrii* were but variations of one species, I could do no other than acknowledge the incorrectness of my former opinion. Dr. Boisduval appears also to have once been led into the same error, and afterward to have rectified it, as he leaves *Clarius* out of the list of species in his "Lepid. Calif., 1869." The clearness of the white ground, the size of the colored spots, and the presence or absence of the red basal patches of the under side, do not appear to constitute permanent characters, though at first sight they would seem to indicate distinct specific relations, while the size of the insect and the intensity of the colored patches seem to be modifications resulting probably from various altitudes, those of the less elevated regions being usually most pronounced in color. It should be remembered that *Clarius* was described by Eversman from specimens taken in the Altai Mountains, Siberia, and, on the high authority of Mr. H. W. Bates, our "Californian specimens do not resemble at all *Clarius* of the Altai," so that we have to blame Boisduval for introducing that species into our lists, instead of alluding to our extreme variations (as has been done in the case of *Behrii*) by a new name. That they are worthy of such distinction there can be no doubt, and I propose for perhaps the widest range of variety the following name, the specimens from which the description is taken being in my own collection. It must be borne in mind that this variety wanders considerably farther from the type than that figured by Mr. Edwards as *P. Clarius*, Evers.:

Parnassius Menetriesii. Hy. Edw. n. var. of *Clodius*. Menetr.

Imago ♂. Smaller than the typical forms of *Clodius*. Ground color of wings, sordid white; semi-transparent margin rather narrow, with the white lunules indistinct; the whole of the black marks of primaries are fainter than in *Clodius*, and there is no black spot in the submedian interspace. The sec-

ondaries have the abdominal margin comparatively more deeply edged with black, the line being distinctly bent inwardly toward the extremity of the cell; the colored spots are very small, almost obsolete, becoming simply pale pinkish or yellowish dots, surrounded by a narrow black ring. Under side vitreous, with a yellower tinge than above; all the marks fainter, except the colored spots of the secondaries, which are here, though small, distinct in color, and have white pupils. There is also a faint indication of a black bar on the anal angle, but no trace whatever of crimson basal patches. Head, thorax and abdomen beneath densely clothed with deep yellow hair, much darker and a more brilliant tint than in the typical form.

Exp. of wings, 2.25 inch.

♀. In nearly all respects this sex of the present variety resembles the ♂ of the type, and would at first sight be certainly so regarded. The transparent space of primaries is much smaller than usual; the bands are narrower and less defined, so that the white area of the wing is nearly as large as that of the male insects. The black patch in the submedian interspace is rather large, and the veins more sharply marked throughout. The secondaries have the colored spots small, but distinct in color, mostly pale crimson or orange, and surrounded by a black ring. The abdominal margin is only faintly black, and there is a trace of a black bar at the anal angle, which is, however, entirely without red. Under side similar to the upper in the black markings; the colored spots of secondaries are bright in color, and in some specimens there are two basal red patches, the anal bar more distinct than above, but without red. There is a seam of yellow hair along the abdominal margin, surmounted by yellow scales, a character which I do not find in my typical specimens of *Clodius*, and the yellow hair of the thorax and abdomen are almost golden in their tint.

Exp. of wings, 2.50 inch.

Bear Valley, Sierra Nevada (Hy. Edw.), Lake Tahoe (Hy. Edw.), Downieville, Cal. (Dr. Behr), Mt. Nebo, Utah (I. D. Putnam).

Parnassius Smintheus. Dby. Var. *Behrii.* Edw.

I have two specimens of this insect in my collection, one taken by Mr. J. Hutchings, of Yosemite, on the top of Mt. Dana, Cal., at an elevation of 10,000 feet, and the other by Mr. I. D. Putnam, in Summit Cañon, Utah. It is somewhat singular that the typical form of *Smintheus* never occurs in California, while the variety should be found here. Both of my specimens have the spots orange, and the double row of marginal lunules on the secondaries so characteristic of this strongly marked form.

Pieris venosa. Scud.

Perhaps there is no group so puzzling to an entomologist as that of the genus *Pieris*, to which this species and its allies belong, and the number of names which we find in our catalogues are the natural outgrowth of the widely different variations which we find in collections. Our Pacific Coast species rather tend to increase the confusion than otherwise, and in the separate opinions which exist as to their specific rank the complication becomes more and more intri-

cate and unsatisfactory. In Lepid. *Heteroc. et Rhopt.*, No. 8, Mr. H. Strecker has advanced the idea that *P. venosa* and *P. castoria*, Reakt., are one and the same thing, and that they are simply the American forms of the European *P. Napi*, and I can, after an examination of many scores of specimens, but simply endorse his views. That *venosa* and *pallida*, Scud., = *castoria*, Reakt., are at times represented by widely differing varieties no one can deny, and if we take the extreme forms we should naturally regard them as distinct species; but intergrades may always be found, and among these intergrades we find what Scudder designated as *pallida*, which more nearly approaches Reakirt's type of *castoria* than it does that of Scudder's *venosa*. But the insects are not, as has been suggested, spring and summer generations, as they are both found together, appearing in early spring (sometimes in February), and continue on the wing until the end of April or the beginning of May, when they begin to die out. But admitting *P. venosa* and *P. pallida* to be forms of the same species, what becomes of *P. oleracea?* Among my specimens captured during the present year, as well as others taken in Colorado, Oregon, Vancouver Island, and Northern California, are some which continue the series of intergrades until they are merged into the exact counterparts of the Atlantic species of *P. oleracea*, and cannot be in any way distinguished from the well known species of the Eastern States. Is *P. oleracea*, then, but another form of a trimorphic or polymorphic species? Then, again, many of the individuals of *P. pallida* approach very closely (so closely as to suggest the very nearest relation), others of *P. Rapæ*, and the form described by Mr. Scudder as *P. marginalis*, and afterwards by Mr. Reakirt as *P. Yreka*, can sometimes scarcely be distinguished from the varieties of *pallida*, upon which Reakirt founded his *castoria*. Do not, then, our American examples serve very powerfully to prove the common origin of all these forms, and show that we have hitherto attached too much value to what is designated a species, believing certain characters to be permanent, when, in fact, they are so only under the light of our limited knowledge? To illustrate more clearly my meaning, let us take a strongly marked and darkly colored specimen of *P. venosa* as our starting point, and we shall pass through the various stages thus, our insects becoming paler, and with the markings less pronounced, as we proceed.

1.	*P. venosa*. Scud.	Veins of underside of secondaries, broadly bordered with black scales; the lines of equal width to the margin of the wings.
2.	" "	Veins narrowing at the margin, with the ground color of the wings more yellow.
3.	*Hulda*. Edw.	Veins with their accompanying black scales, sometimes becoming confused, and spread over the whole surface; the lines of scales being sometimes quite indistinct, at others well marked and approaching the following:
4.	*Napi*. L. (Germany.)	Surface of secondaries, yellow, with the nerves bordered by black scales, the lines being narrower as they near the margin.

5. *frigida*. Scud.	Like *Napi*, but with the whole of the lines a little narrower and fainter.
6. *Napi*. (Colorado.)	Lines all very faint, almost obsolete as they approach the margin.
7. *Napi*. (Massachusetts.)	Lines still fainter, quite obsolete at the margin, with the ground color of the wings still yellow.
8. *pallida*. Scud. =*castoria*. Reak.	Ground color usually white, sometimes pale yellow, with the lines bordering the nervules, very faint or quite obsolete, passing by many gradations into the following:
P. oleracea.	Veins without margins of scales, surface white or pale yellow.

We may pursue this still farther, until we arrive at a form of *oleracea* almost pure white, in which even the nervules themselves are scarcely to be traced by any definite color. But the subject may perhaps be better illustrated by retracing our steps, this time starting with *oleracea*, and endeavoring to show its relationship to *P. Rapæ*.

1. *P. oleracea*.	Almost pure white, with faint yellowish tinge beneath. ♂ without spots.
2. " (Oreg. and N. Cal.)	White, with very faint indications of spots on the primaries.
3. *Castoria*. Reak.	White, with faint yellowish tinge. ♂ with faint spots on the primaries.
4. *Marginalis*. Scud.	White above, yellow beneath on secondaries. ♂ with distinct spots on primaries, and with the apex slightly dusky.
5. *Ergani*. (Europe.)	♂ with the apex more broadly dusky, and with the spots on primaries well defined.
6. *Rapæ*. L.	Apices broadly dusky. Spots very distinct and well defined. Underside of secondaries, white, greenish white to yellow.
7. *Novangliæ*. Scud.	Upper and lower surfaces yellow, spots and apices as in *Rapæ*.

Thus it will be seen, that according to my views, two branches of variation have proceeded from the one original source, though what that original source may be we are at a loss to tell, and that the most special characters distinguishing these two branches belong to *P. Pallida*, which in many respects resembles *P. Rapæ* as much as it does *P. Napi*. I am aware that there are other points of difference between the extremes of these insects, but certainly none more remarkable than between the darkly veined specimen of *P. venosa*, and the almost immaculate and veinless examples of *P. Pallida*.

Breeding the caterpillars through successive generations, will alone lead us to the truth, and unhappily at present we know but little of the earlier stages of these creatures. The present remarks must therefore be taken as a suggestion rather than the dogmatic statement of a fact.

Pieris calyce. W. H. Edw.

I am inclined, from the examination of a specimen in Dr. Behr's collection, to believe that this is the Spring generation of *P. occidentalis.* Dr. Behr's specimen was taken by Mr. R. H. Stretch, in April, in Carson Valley, Nev., and mine, from which the original description was made, and which is now in the possession of Mr. W. H. Edwards, was caught by myself near Reno, Nev. in the end of March. *P. occidentalis* occurs in the same localities in May, June and July.

P. Beckeri. W. H. Edw.

This species is said by Mr. Strecker and others to be identical with the Russian *P. Chlorodice*, Hb., differing only by its larger size. In support of this opinion, I may state that in my collection are two specimens (♂) from the Coast Range in Mendocino County, measuring only 1.50 inch in expanse, while those from Virginia City are over 2.00 inches; the smaller examples in no other respect differing from the Nevada specimens.

Nathalis Iole. Bois.

This pretty little species, as well as the var. *N. Irene*, Fitch, must be included in the list of Pacific Coast Butterflies, having been taken in some abundance near San Diego by the late G. R. Crotch, G. W. Dunn and others. It is extremely abundant near Cape St. Lucas, and in various portions of the country on the eastern side of the Gulf of California.

Anthocaris Creusa. Dby.

I have little doubt, from an examination of a figure by Mr. Butler of the British Museum, kindly loaned to me by Mr. W. H. Edwards, that this species is the same as *A. Hyantis*, Edw., which is well known to occur in the Sierra Nevada, and in other high lands in this State. It is said by Dr. Behr to be far from rare in the neighborhood of Oroville, and has been taken recently by Baron d'Osten Sacken in the Yosemite Valley, and by myself near Lake Tahoe. It is probably often confounded with *A. Ausoniedes*, but is abundantly distinct.

Anthocaris olympia. Edw.

This exquisite species exists in my collection from Colorado, near the Utah border, where it was taken by Mr. Winslow Howard.

Anthocaris Reakirtii. Edw.

I think I am wholly to blame if this should turn out, as I now suspect it to be, only a form of *Sara*, Bdv., as it was entirely through my statements that Mr. W. H. Edwards erected it to the rank of a species. The main points of difference are the smaller size, the irrorations of the costa, the straight line enclosing the orange apical spot, and the white females. But I find of late years, that these characters are by no means permanent, and that all gradations may be found. It is most probable, therefore, that *Reakirtii* is the

spring generation, and *Sara* that of the summer. The former appears very early in March, and the latter in May and June. The ♀♀ of *Reakirtii* are at times, though only rarely, as yellow as those of *Sara*, and the irrorations upon the costa are as frequent in the latter as in the former.

Anthocaris lanceolata. Bdv. = *A. Edwardsii*. Behr.

In most of the males I have seen, the apices are only very slightly clouded with dusky scales but in two specimens taken in Kern County by Mr. R. H. Stretch, they are broadly and distinctly clouded, thus more closely resembling the other sex.

Callidryas eubule. L.

Examples of this species, of both sexes, were taken in San Diego, in August, 1875, by Mrs. James Behrens, flying about the streets of the city, and settling upon the flowers of the gardens. I have since received other specimens from Mr. G. Hitchcock, of San Diego.

Colias eurydice. Bdv.

Between the spring and autumn generations of this beautiful insect a great variation occurs, which is quite constant in all the examples which have come under my notice. In the spring specimens, which may be regarded as the type, and which make their appearance in April and May, the secondaries of the ♂ are wholly bright orange, without any spots or marks upon the margin, except some brown dots to note the termination of the nervures, while the ♀ is, with the exception of the large discal spot of the primaries, and a very faint brown marginal line, quite immaculate. The autumn brood, however, appearing in July and August, have the secondaries of the ♂♂ with a black marginal border, sometimes one and one-half or two lines in width, and the ♀♀ have the margins distinctly marked with brownish patches, and occasionally (though rarely) with a black submedian band, composed of clouded patches, interrupted by the nervules, reaching from the costa to the interior margin. If deemed worthy of a name, I should propose for this strongly marked form that of

C. eurydice. Var. *Amorphæ*. Hy Edw.

I have recently received from Mr. O. Barron, of Mendocino County, a magnificent variety of this species, in which the whole of the yellow space of the primaries (which usually bears the name of the "dog's head") is suffused with the richest purple, the orange being only slightly visible beneath it, thus giving the insect a most striking appearance.

Terias Nicippe. Cram.

Taken in Kern County, by Mr. R. H. Stretch, and by Mr. Dunn and others, near San Diego.

Terias Mexicana.

Taken in the neighborhood of San Diego by Miss Marcia Crane, and near San Bernardino by the late G. R. Crotch.

Euptoieta Hegesia. Cram.

This species is very common in Lower California, and occasionally wanders over the border into this State. I have received specimens taken undoubtedly within our limits, but it must at present be regarded as a rarity.

Agraulis Vanillæ. L.

Very abundant in the gardens of San Diego in August and September. (Mrs. Jas. Behrens.)

Argynnis Liliana, n. sp. Hy. Edw.

I am unwilling to add another to the already long list of *Argynnis*, but can see no other way out of the difficulty which is presented to me by some specimens taken by me in Napa County. I have, however, much pleasure in dedicating what I believe to be a true species, to my friend, Mrs. Lillie Coit, who has added many great rarities to my collection, and at whose country residence, in one of the most charming portions of the State, the species seems to have made its home. It is intermediate between *A. Calippe*, Bdv., and *A. coronis*, Behr., partaking of the characters of both, yet I think distinct in the following details:

It is darker in color of the upper side than *A. coronis*, and very much darker than *A. calippe*, being of a rich reddish brown. The markings above similar to those of these two species. Beneath, the primaries are largely suffused with reddish brown, as in *coronis*, but the remainder of the wing is occupied by bright buff, not dull ochreous as in *coronis*. The silver spots of the margin are very decidedly triangular, and not ovate as are the apical ones of *coronis*. On the lower wings the differences are more apparent. The silver spots are larger proportionally than in any other species with which I am acquainted, while the sheen of the silver is exceedingly vivid and intense. The marginal spots are quite triangular, and the large one of the cell more decidedly oblong than either in *A. coronis* or *A. calippe*. The ground color of the wing is bright buff, inclining to orange; much the same color as in *A. rupestris*, and by no means brown as in *A. coronis* and *A. calippe*, thus giving a brighter and more lively appearance to the whole of the underside.

Without forming a *positive* conclusion as to its value as a species, I think this form well worthy of a separate name. I have taken it for three seasons past near St. Helena, Napa Co., and altogether have had before me thirty-four ♂ and seven ♀, all of which are true to their own type, presenting among themselves little or no variation. When placed side by side with long series of the closely allied species, this insect presents at once so great a difference as to strike the observer, being quite as complete as that between *A. coronis* and *A. pervadensis*. The actual position of many of our *Argynnis* as species, can only be determined, however, by watching the insects through their various stages.

Argynnis monticola. Behr. Var. *purpurascens.* Hy. Edw.

Under this name I wish to recognize the form of *Arg. monticola*, which is found chiefly in Siskiyou County, in the region surrounding Mt. Shasta, as

well as in some parts of Oregon. It differs from the type, by the larger amount of black on the upper surface, visible in both sexes, by the smaller size, and by the more suffused appearance of the lower side. The spots are somewhat larger proportionally than in the type, in this respect resembling *Zerene*. Behr, and the basal half of the secondaries is much darker in color, while the margins of all the spots are larger and more intense. The whole of the underside is also tinted with a purplish efflorescence, very visible in fresh specimens. The female is always deeply suffused with black on the lower side, and almost invariably has the spots either partially or wholly silvered, a character not observable in the typical *monticola*. This beautiful variety was first taken by Mr. W. G. W. Harford, at the Dalles, Oregon, and subsequently by Mr. J. Behrens at Soda Springs, Siskiyou County, in which last named locality I took about forty specimens, all characterized as mentioned above, in the fall of 1875. It closely connects *A. monticola* with *A. Zerene*, and may have been under Dr. Boisduval's eye when he confounded these two species.

Argynnis myrina.

Though not found in California or Oregon, this species was taken in abundance near Sitka, Alaska, by the late Mr. Bischoff. The specimens are smaller than those of the Eastern States, and the whole of the underside brighter in color, with the silver spots proportionally of a larger size.

Melitæa Leanira. Bdv. Var. *Obsoleta.* Hy. Edw.

Near San Rafael, in Marin County, I annually take specimens of a very curious variety of *M. Leanira*, so constant in its characters as to suggest the idea of a new species. In the lower side of the typical form, the secondaries are marked with black blotches near the base, and a double submedian band inclosing a series of seven spots of the pale ochraceous color of the ground. In the variety *obsoleta* these marks are all obliterated, and nothing appears but the black nervules and a slight black marginal line. In all other respects the insect agrees with the typical form. It is somewhat singular that in the locality in which these varieties are found I never met with the true *Leanira*, which is always a very local insect, and that, although I know several localities in which *Leanira* is found, it is only in the one mentioned above that I ever met with the var. *obsoleta*.

Pyrameis. *Hybrid* between *P. Caryæ* and *P. Atalanta.*

Hybrids among diurnal Lepidoptera are very rare, and the present is a very interesting form, worthy of record. It was raised by Dr. H. Behr from a caterpillar found feeding on nettles (*urtica*) at Lagunitas, Marin County, in July, 1876. The perfect insect appeared in August. It presents a very singular conjunction of the characters of the two species, of which it is undoubtedly a hybrid. The spots across the primaries form a bent macular band, the sub-apical spot being red and not white as in *Atalanta*, the base of the wing behind the band being rusty red. The secondaries are blackish nearly over

the whole surface, with reddish hairs, which are longest toward the base; the submarginal row of ocelli similar to those of *caryæ*, only with white pupils. The under side is that of *Atalanta*, the abdomen being neither black nor red, but brownish, the color of the anal margin of the hind wings. Altogether it is a very remarkable production of the two species, and should be figured, so that such an interesting hybrid may not be lost.

Limenitis Lorquini. Bdv.

In all the specimens I have received from Vancouver Island, the ground color of the under side has a purple tint in place of the snuff-brown of the usual form, and in two specimens received from near Virginia City, Nevada, taken by Mr. W. Eaves, I note more remarkable changes. On the upper side the white macular band is very narrow, and is edged on the secondaries posteriorly by a very distinct row of ovate orange spots, reaching quite to the costa, while inside the ochreous apical patch of the primaries, and beneath the outer band of three white spots, which is peculiar to the species, there is a duplex spot also of orange. Beneath, the wings have considerably more white than the type, and the basal spots of the secondaries are clear white and oblong in shape. I desire to record this well-marked variety by the name of *Limenitis Lorquini*. Var. *Eavesii*. Hy. Edw.

Coenonympha Eryngii. n. var. Hy. Edw.

Under this name I wish to recognize a remarkable form of *C. californica*, taken by me in considerable numbers at Soda Springs, Siskiyou County, in the fall of 1875. The upper side is exactly that of *C. californica*, var. *galactina*, wanting the black or dusky hairs at the base of the wings, the thorax and abdomen being concolorous. The under side is characterised by the usual straight band on the primaries and the waved or dentate line of the secondaries, but there is an utter absence of points, spots or ocelli, in this respect closely approaching the ornamentation of *C. inornata*. I took this insect only in one locality, flying about the beautiful *Eryngium petiolatum*, Hook, which here attains a large size, and a most brilliant bluish color.

Size of *C. californica*. Soda Springs, Siskiyou County, Cal. Hy. Edw., August. (11 ♂; 9 ♀; Coll. Hy. Edw.)

Thecla sæpium. n. var. *fulvescens*. Hy. Edw.

A very strongly marked variety of *T. sæpium* occurs rarely throughout the State. It is usually smaller than the type, and very much paler in color, being occasionally of a golden brown instead of chestnut tint. The fringes are whiter than in *T. sæpium*, the under side much fainter in color, with the markings less pronounced, and the submarginal band always more distinctly edged with white. It may prove ultimately to be a new species, but for the present I prefer to regard it as a variety of the common form alluded to.

Lake Tahoe, Hy. Edw Tehachepi Pass, R. H. Stretch. Havilah, Kern County, R. H. Stretch. (2 ♂; 2 ♀; Coll. Hy. Edw.)

Thecla melinus. Var. *pudica*. n. var. Hy. Edw.

I have before me two specimens (♂ ♀) of an insect which at first sight appeared to me a new species, but which I now think can only be considered a

variety of *T. melinus*, Bdv. It is considerably smaller than *melinus*, being only 0.90 inch in expanse, while *melinus* measures 1.25 to 1.30 inch. The upper side is similar to that of *melinus*, but the lower side is more silvery gray, with the markings in the primaries utterly obliterated, and a distinct black line at the base of the fringe. The markings of the secondaries are similar in outline to those of *melinus*, but they are extremely faint, and the anal orange spot is almost obsolete, while the red bordering to the submarginal band, so conspicuous in *melinus*, is here reduced to a few scattered scales.

Contra Costa County. Hy. Edwards. June, 1875.

Perhaps a long series of specimens will show the identity of *T. melinus*, Bdv., and *T. humuli*, Harr., but in all the examples I have seen of the latter, I miss the red scales bordering the submarginal band above alluded to. But beyond this, I see no character by which they can be separated.

Lycæna speciosa, n. sp. Hy. Edw.

Pale silvery blue, the color of *L. mellisa*, Edw. Fringes, very broad, clear white, cut very distinctly by black at the ends of the nervules. Underside, pale silvery gray, with a very minute round black spot on the costa, and a series of five round sub-marginal and one oblong central spots arranged almost in circular form on the disc. There is also a distinct oblong discal spot, and a smaller round one on the internal margin. The whole of the spots on the primaries are comparatively large, very distinct, and jet black, without white margins. The secondaries have one basal dot, a minute discal point, and a sub-marginal row of seven small black spots, also without white margins. Fringes, as in the upper side. Anterior, with the club unusually large, and the shafts distinctly annulated with white. Thorax and abdomen, blackish above, silvery beneath.

Exp. of wings, 0.70 inches.

Havilah, Kern County, R. H. Stretch. (1 ♂ Coll., Hy. Edw.)

I should have hesitated to describe this exquisite species from a single specimen, but the peculiar arrangement of the spots on the lower side of the primaries, its extremely small size, and the broad and distinctly black and white fringes serve abundantly to distinguish it from any other form with which I am acquainted.

N. B. As I intend to devote a separate article to the species of *Colias* proper, I have omitted all reference to that genus in the present paper.

Professor Davidson read a continuation of his papers on Irrigation, describing the canal Cavour.

The Committee on Nomination submitted the following report:

The Committee appointed to present a ticket of officers to the Academy to be voted for at the coming election, beg to offer the

following report. They have carefully considered the responsible duty assigned to them, and have unanimously resolved to recommend to the Academy the re-election of the present officers and Trustees. They were led to this conclusion by a consideration of the unsettled condition of the temporalities of the Academy. Many matters of grave importance, and at the same time affairs of a complicated and delicate nature have often been under consideration at the joint meetings of the Council and Board of Trustees, and it seemed to them only ordinary prudence to continue these gentlemen in office. We therefore recommend the following ticket:

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HENRY EDWARDS.

SECOND VICE-PRESIDENT,
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WM. ASHBURNER,
GEO. E. GRAY,
JOHN F. MILLER.

(Signed,)

Horace Davis, Wm. Norris, J. H. Smythe, P. B. Cornwall, S. P. Christy.

On motion, Dr. A. Kellogg and S. P. Christy were appointed Inspectors, and Chas. Wolcott Brooks and Henry Chapman Judges of Election.

MEMBERS ELECTED DURING THE YEAR 1876.

Jan. 3d.—W. B. Burleigh, Louis Nussbaumer.

Jan. 17th.—Z. W. Greene, Dr. James Murphy.

February 7th.—Dr. J. S. Crook, W. J. Graves, Gerrit L. Lansing, Dr. R. K. Nuttall, Samuel Purnell, C. L. Scudder, Joseph Tilden.

March 6th.—H. S. Craven, J. S. Curtis, E. B. Dorsey, James D. Hague, W. H. Hall, Charles Barton Hill, Louis Janin, C. W. Lightner, Alfred Poett, Howard Schuyler, W. A. Skidmore, Hamilton Smith, Jr., C. A. Stetefeldt.

March 20th.—C. F. Dio Hastings.

April 17th.—T. Bechtinger, Joel F. Lightner, S. Lubeck, J. F. Myers, J. K. Wilson.

May 15th.—Albert Arents, Louis Falkenau, C. A. Luckhardt, Emlen Painter, H. W. Reese.

June 5th.—Walter W. Dannenberg, L. L. Hawkins, Edward N. Moor, Robert Chalmers Lord.

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ERRATA.

PAGE.				
18,	9th line from	top,	for	"*melanstchthys*" read "*melanostictus.*"
18,	13th "	"	"	"*Librocedrus*" read "*Libocedrus.*"
18,	4th "	bottom,	"	' chalcedomy" read "chalcedony."
20,	16th "	"	"	"*Astragulus*" read "*Astragalus.*"
21,	12th "	top,	"	"*Fuschia*" read "*Fuchsia.*"
22,	3d "	"	"	"Zygæindæ" read "Zygænidæ."
24,	8th "	"	"	"Fuschia" read "*Fuchsia.*"
27,	7th "	"	"	"Equisiti folia" read "*equisetifolia* "
38,	8th "	"	"	"*Nevadensis*" read "*Nevadense.*"
38,	12th "	"	"	"*Newberyi*" read "*Newberryi.*"
38,	7th "	"	"	"*Marselia*" read "*Marsilia.*"
38,	9th "	"	"	"*Cyclademia*" read "*Cycladenia.*"
38,	10th "	"	"	"*pulsifera*" read "*Pulsiferæ.*"
38,	10th "	"	insert	"*A.*" before "*Webberi.*'
38,	15th "	"	for	"*microcephalum*" read "*microcephala.*"
38,	15th "	"	"	"*cecaule*" read "*algida.*"
38,	16th "	"	"	"*Emmenanthus pusillus*" read "*Emmenanthe pusilla.*"
38,	16th "	"	"	"*librocedri*" read "*libocedri.*"
38,	17th "	"	"	"*Leucothæ Davisæ*" read "*Leucothöé Davisiæ.*"
38,	18th "	"	"	"*occidentalis*" read '*occidentale.*"
38,	18th "	"	"	"*cuphosbia*" read "*euphorbia.*"
38,	19th "	"	"	"*scapigernum*" read "*scapigerum.*"
38,	19th "	"	"	"*Pattensis*" read "*Plattensis.*"
38,	4th "	bottom,	"	"Artemesia" read 'Artemisia."
44,	5th "	"	"	"Bhering's read "Behrings."
44,	3d "	"	"	"*Idotæga*" read "*Idotæga.*"
49,	4th "	top,	"	'*nebuloseum*" read "*nebulosum.*"
49,	6th "	"	"	"*Dyadophis*" read "*Diadophis.*"
49,	9th "	"	"	"forma also on" read "found also in."
49,	7th "	bottom,	"	'Echni" read "Echini."
49,	4th "	"	"	"Brickelia" read "Brickellia. '
59,	6th "	"	"	"Segnathus " read "Syngnathus."
82,	10th "	"	"	"*Sasmicossiphus*" read "*Semicossyphus.*"
91,	18th "	"	"	"Tamelpais" read "Tamalpais."
91,	5th "	"	"	'*obtusioloba*' read "*obtusiloba.*"
92,	15th "	"	"	"*cilliata*" read "*ciliata.*"
111,	5th "	top,	"	"*Aralea*" read "*Aralia.*"

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112, 12th line from top, for "*Leucothœ Davisœ*" read "*Leucothöe Davisiœ*."

114, 5th " " " "Alfred A. Pinaut" read "Alphonse Pinart."

115, 2d " " " "*tenells*" read "*tenellus*."

115, 6th " " " "*Rannunculus*. Eisenii" read "*Ranunculus Eisenii*."

121, 7th " " " "demar" read "Damar."

121, 11th " " " "McGillwray" read "McGillivray."

126, 3d " bottom, " "echeneus maceatus" read "Echeneis naucrates."

130, 13th " top, " "inteeinnatarite" read "metacinnabarite."

130, 11th " bottom, " "andaluriate" read "Andalusite."

130, 8th " " " "anceforsil" read "and fossil."

130, last line, for "inormtnm" read "mountain."

132, 5th line from top, for "Lithobre" read "Lithobii."

143, 8th " top, " "*Castaneopsis*" read "*Castanopsis*."

151, 9th " bottom, " "*strigosus*" read "*strigosus*."

156, last line, " "*cristala*" read "*cristata*."

167, 16th line from " " "*Ergani*" read "*Ergane*."

168, 13th " " " "*Ausoniedes*" read "*Ausonioides*."

170, 5th " " " "*Argynuis*" read "*Argynnis*."

171, 5th " top, " "Behr" read "Bdv."

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